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SURGICAL APPROACH FOR SO-CALLED GLOMUS JUGULARE TUMORS OF THE MIDDLE EAR.*†

GEORGE E. SHAMBAUGH, JR., M.D.,

Chicago, Ill.

In the last few years the otologic literature has contained numerous reports of a primary vascular tumor peculiar to the tympanic cavity and now generally referred to as glomus jugulare tumor of the middle ear. Seven of these tumors have been seen by the author and his associate Eugene Derlacki, and six have been operated. In two cases a new "hypotympanotomy" surgical approach was utilized to gain access to the tumor without sacrificing the hearing.

The glomus jugulare is a tiny structure normally occurring in the adventitia of the dome of the jugular bulb immediately below the hypotympanum and close to the ramus tympanicus of the glossopharyngeal nerve. Measuring scarcely 0.5 mm. broad by 0.25 mm. thick this minute ovoid structure was first described in 1941 by Guild¹ who observed that it usually consists of a single glomus or mass of vessels of capillary or pre-capillary size with numerous epitheloid cells between. Occasionally, instead of a single glomus, two or more smaller bodies are present, sometimes one or all are in the canal that transmits the ramus tympanicus of the glossopharyngeal nerve through the floor of the middle ear, and in one case the body occurred along the course of this nerve over the cochlear promontory. Because histologic structure and nerve

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† From the Department of Otolaryngology, Northwestern University and Wesley Memorial Hospital, Chicago.

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and blood supply from the glossopharyngeal nerve and ascending pharyngeal artery are similar to the carotid body or glomus caroticus, Guild suggested for it the name *glomus jugularis*.

Four years after Guild's description Rosenwasser² reported a primary vascular tumor of the middle ear arising from the hypotympanum and having the histologic structure of a carotid body tumor. He suggested that it might have come from the *glomus jugularis* of Guild, and proposed the name *glomus jugulare tumor*. Prior to Rosenwasser's article the literature contained sporadic reports of similar vascular tumors of the middle ear diagnosed simply as *angioendotheliomas* or *hemangioendotheliomas*. The earliest such report that I have encountered was by Joseph C. Beck³ in the *Illinois Medical Journal* in 1906, but an exhaustive search especially of the European literature might well disclose earlier reports.

Since Rosenwasser's naming of this tumor a number of excellent articles on *glomus jugulare* tumors of the middle ear have appeared, including a report of eight new cases from Columbia University by Lattes and Waltner⁴ in 1949, and 11 new cases by Lester Brown⁵ in 1953. From the numerous published reports, and our own experience, certain characteristics that seem peculiar to these tumors can be enumerated:

1. There exists a definite predilection for *angioendotheliomas* to occur in the tympanic cavity, often arising from the hypotympanum but sometimes directly from the dome of the jugular bulb. Their histologic structure and point of origin strongly suggest that they arise from the *glomus jugulare* structure of Guild, as proposed by Rosenwasser.

2. They occur in young and middle-aged adults more often than in the later years, when carcinoma is more prevalent. I have encountered no cases reported in children.

3. They are generally quite slow growing but are locally invasive. In a few instances they have been frankly malignant with a much more rapid invasive growth, regional and distant metastases, and fatal termination from intracranial extension.

4. The symptoms begin with an early conductive hearing loss, often with a pulsating tinnitus synchronous with the pulse. As the tumor invades and extends through the tympanic membrane otorrhea frequently occurs. Profuse bleeding, spontaneous or more often following instrumentation and biopsy, becomes a prominent and alarming symptom. As the tumor invades the surrounding bone, facial paresis, vertigo, profound or total inner ear deafness, headache, and finally involvement of the nerves of the jugular foramen appear.

5. Otoscopic examination in the earliest stage is characteristic: a sharply defined reddened or bluish mass in the tympanic cavity behind the intact tympanic membrane. In one of our cases this had been misinterpreted elsewhere as a Schwartze's sign from a vascular otosclerotic focus, but utilizing the magnifying speculum and keeping in mind the early appearance of these tumors there should be no confusion.

Later when the tumor has protruded through the tympanic membrane into the meatus one will see an ordinary appearing polyp, often with more or less purulent discharge around it. The profuse bleeding, controlled only by packing the meatus when the polyp is removed, may offer the first clue of the correct diagnosis. Unless the growth is far advanced with extensive erosion of surrounding bone the X-ray picture is not helpful. The definitive diagnosis is made by histologic examination revealing an angioendothelioma, which because of its site of origin may be classified as a glomus jugulare tumor of the middle ear.

6. Lester Brown⁵ has described a "pulsation sign" that he believes is particularly characteristic of these tumors. With a Bruening-Siegel speculum that fits tightly into the meatus one observes the tumor while increasing the pressure in the meatus with the attached rubber bulb. As the pressure is slowly increased the tumor is seen to pulsate, sometimes almost violently, or if already pulsating, the pulsations are seen to increase. Then as the air pressure is further increased the tumor will blanch and the pulsations cease, only to recur as the pressure is slowly released, reaching a maximum and then diminishing again as the intrameatal pressure returns to normal. We have recently tried this test exactly as de-

scribed by Brown, and we have observed pulsations of some of the tumors through the magnifying speculum, that disappeared on carotid pressure.

7. Most authors⁶ do not regard these tumors as radio-sensitive, although a good many of the reported cases were irradiated preceding or following surgical removal.^{4,5,7}

8. Surgical removal by means of a radical mastoidectomy to expose the tumor in the tympanic cavity has been the treatment generally recommended, except for far advanced growths which by X-ray had destroyed much of the petrosa and were considered inoperable.

In the majority of reported cases surgical removal has resulted in freedom from recurrence, but most of the cases had been followed for less than five years. Lattes and Waltner⁴ do report one case without recurrence 17 years after surgical removal.

Our own experience with these interesting neoplasms began several years ago when we were not yet attuned to the early clinical picture of the glomus jugulare tumor. This was a middle-aged woman complaining of an annoying pulsating tinnitus in the right ear. Behind a normal tympanic membrane a sharply defined reddened mass was seen to occupy the anterior inferior third of the tympanic cavity, with visible pulsations that disappeared along with the tinnitus on carotid artery pressure. An aneurysmal enlargement of the carotid artery, where it passes just in front of the tympanic cavity, was suspected, but much more likely this patient had had an early glomus tumor which we failed to recognize.

Of the six cases that we have operated (see Table), the first two were moderately advanced tumors that filled the tympanic cavity; one protruded through the tympanic membrane into the meatus, both had resulted in total or profound nerve deafness with vertigo in one, and at operation both were found to arise from the dome of the jugular bulb with erosion of the floor of the hypotympanum. In both a similar surgical technique was employed for removal.

Because of the profuse bleeding that occurred with the

SIX OPERATED GLOMUS JUGULARE TUMORS

No.	Sex	Age	Symptoms	Duration of	Otoscopic	Hearing and Caloric Tests	Surgical Procedure	Operative Findings	Result
1	male	35	Progressive Deafness Left ear	1½ yrs.	Red Tumor behind M.T.	Dead labyrinth	Ligation Int.-Jug. Vein Radical mastoid and Exposure jug. bulb	Tumor arose from jugular bulb	4 yrs. 10 mos. No known recurrence
2	male	27	Sudden Deafness Left ear	3 mos.	Red Tumor protruding through lower edge of M.T.	Profound Nerve Deafness Neg. Caloric	Ligation Int.-Jug. Vein and External carotid A sigmoid sinus packed OH. Rad. Mastoid & exposure jugular bulb	Tumor arose from jugular bulb	No recurrence 2 years
3	female	46	None	—	Red Tumor behind M.T.	Mild conductive loss	Hypotympanotomy	Tumor arose from floor of hypotympanum	No recurrence 1½ years
4	female	25	Fullness & Pulsation Left ear	1 yr.	Red Tumor behind M.T.	Mild conductive loss	Hypotympanotomy	Tumor arose from floor of hypotympanum	No recurrence 11 months
5	female	45	Progressive Deafness R. ear & Vertigo	1-2 yrs.	Atresia of Meatus	Severe conductive and high tone perceptive loss	Radical Mastoid 9 months later revision	Tumor filled middle ear, attic, mastoid, external meatus and eustachian tube	Died 1 year after first operation
6	female	34	Progressive Deafness Left ear & Otorrhea	7 yrs.	Polyp filled external meatus	Severe conductive loss	Endaural radical	Tumor arose from hypotympanum, filled external meatus, middle ear, attic and antrum	No recurrence 3 months

preliminary biopsy and our suspicion that they might arise from the jugular bulb, the internal jugular vein was first ligated, and in addition the external carotid artery was tied off, and the sigmoid sinus packed off in one. By means of an endaural radical mastoidectomy the tumor mass filling the tympanic cavity was exposed with profuse bleeding each time the tumor was disturbed, controlled only by iodoform gauze packs.

The hypotympanum and jugular bulb were then exposed by resecting the entire tympanic bone forming the anterior, inferior and posterior osseous meatal wall until the ascending portion of the carotid artery in its bony canal, the facial nerve emerging from the stylomastoid foramen and the jugular bulb with the attached tumor protruding upward into the tympanic cavity lay fully exposed. This was done without any attempt to mobilize or remove any of the tumor, thus avoiding the profuse bleeding that obscured the surgical field whenever the tumor itself was manipulated.

As Weille and Lane⁸ so aptly put it "the patient was removed from the tumor rather than the tumor from the patient." Only when the tumor lay fully exposed was it rapidly dissected away from the dome of the jugular bulb, using a small periosteal elevator, with constant suction for the profuse bleeding. When the bleeding had subsided with the help of an iodoform gauze pack, the point of origin on the jugular bulb was cauterized in the first case, using the topical sclerosing solution of Mohs.⁹ Although care was taken not to apply this chemical to the exposed facial nerve, complete facial paralysis followed the operation. In the second case the base of the tumor on the jugular bulb was fulgurated by electrocoagulation, and facial paresis did not result. Both patients have dry, well epidermized cavities, the first nearly five years after operation with no known recurrence (the patient was last seen two years ago, and in the absence of symptoms has not returned); the second with no evidence of recurrence after two years; however, the first patient had a solid jugular bulb at operation, probably filled with tumor, and a dead labyrinth possibly invaded by tumors, so a permanent cure is doubtful.

The complete facial paralysis has partially recovered—perhaps 30 per cent. The second patient had a glossopharyngeal nerve anesthesia of the pharynx before operation, suggesting tumor in the jugular foramen. This anesthesia has recovered only in part, so again we cannot be certain of a cure.

The two most recent patients that have come to us with this condition also had moderately advanced tumors. Case 5 in our series had a more malignant appearing tumor on histologic examination than the other cases, and nine months after an apparently complete removal by radical mastoidectomy there was a recurrence in the Eustachian tube with a large metastatic cervical gland. A second extensive operation to resect the osseous Eustachian tube was nevertheless followed by a fatal termination from evident intracranial extension three months later, one year after the first operation and only two or three years after the first symptom.

Case 6 had a moderately advanced tumor that filled the tympanic cavity, the entire external auditory meatus to the tragus, and the attic and antrum, and appeared to originate from the hypotympanum. This was removed by the usual endaural radical mastoidectomy three months ago, too soon, of course, to draw any conclusions concerning recurrence.

The two of our patients who presented the earliest tumors were Cases 3 and 4 in our operated series. The first, a woman of 46, was referred by Dr. Von Leden who, in a routine otolaryngologic examination, had observed a localized red mass in the posterior half of the tympanic cavity behind a normal tympanic membrane. She denied any ear symptoms but showed a mild conductive hearing loss. In an effort to preserve the normal sound conducting apparatus and good hearing the following technique, first worked out on the cadaver, was employed to expose the tympanic cavity widely via the hypotympanum:

1. The usual Lempert endaural incision as modified by the author and his associates¹⁰ so as to preserve the skin that forms the curve of the posterior meatal wall.

2. A supplementary incision through the skin of the infe-

rior and anterior meatal wall along the outer edge of the osseous meatus.

3. Elevation of the skin of the anterior, inferior and posterior osseous meatal wall as a tube to the sulcus tympanicus, thus exposing almost the entire extent of the tympanic bone.

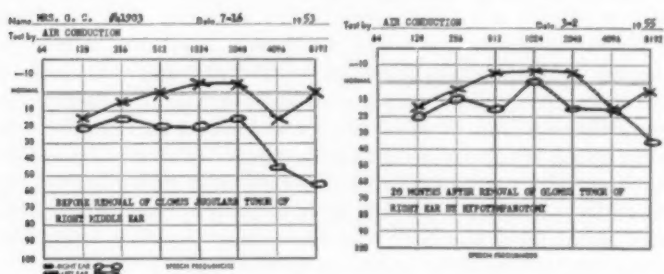


Fig. 1. Audiograms on Case 3.

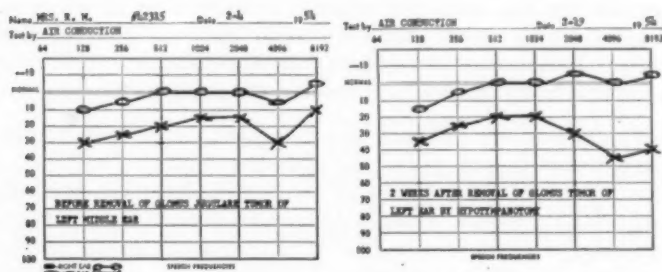


Fig. 2. Audiograms on Case 4.

4. With a dental driven burr the anterior and inferior osseous meatal wall thinned down so as to widen and enlarge downward and anteriorly the osseous meatus. The position of the facial nerve in the posterior meatal wall where it emerges from the stylomastoid foramen must be kept in mind. By removing the floor of the meatus anterior to, but not beyond, a vertical line through the posterior edge of the sulcus tympanicus the facial nerve is safely avoided.

5. Elevation of the annulus tympanicus from its sulcus anteriorly, inferiorly and posteriorly, as first described by Lempert¹¹ and subsequently utilized by Rosen¹² for biopsy of glomus jugulare tumors. This permits the pars tensa to be folded upwards upon itself, exposing all but the upper anterior portion of the tympanic cavity.



Fig. 3. Exposure by Endaural Incision.

6. Resection of the bony sulcus tympanicus inferiorly so as to expose fully the hypotympanum and tumor within it.

7. The tumor in Case 3 fully exposed by this hypotympanotomy with minimal bleeding, was observed to occupy the posterior three-fourths of the tympanic cavity with its base in the hypotympanum and two lobes, one enveloping the incudostapedial joint. The latter was carefully teased away from the stapes to which it was not at all adherent, and both

lobes were then rapidly dissected from the promontory to which they were moderately adherent, and from the floor of the hypotympanum to which they were more adherent, with suction for the profuse bleeding. A millimeter sized opening toward the jugular bulb poured venous blood each time an iodoform gauze pack was removed, until it was controlled by electrocoagulation. Careful inspection of the tympanic cavity

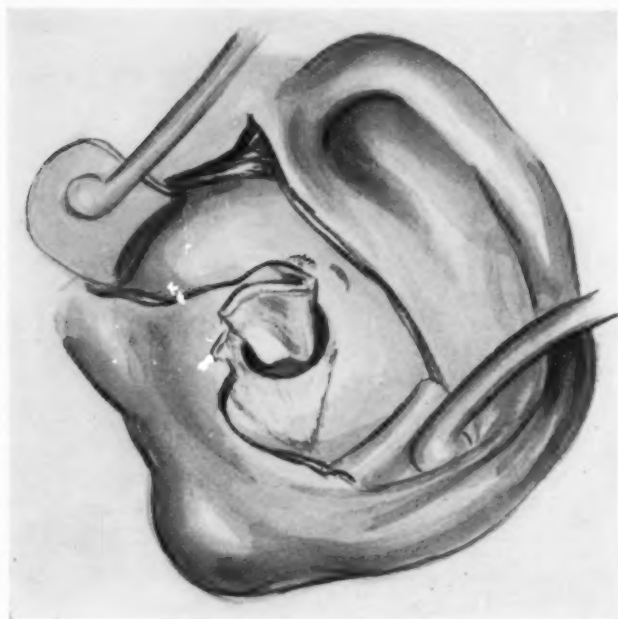


Fig. 4. Incision extended around floor of osseous meatus permitting the skin of the osseous meatus to be elevated upward exposing floor and anterior meatal wall.

with magnification when all bleeding had been controlled revealed no visible remnants of tumor.

8. The tympanic membrane and meatal skin were folded back into position with split thickness skin grafts to line the enlarged meatus where it was not covered by its own skin.

Five weeks after operation the ear was dry and healed, and the hearing slightly improved over the pre-operative test. Six months after operation, however, a small perforation appeared along the inferior edge of the tympanic membrane, which is responding favorably to the Lynn-Derlacki¹³ closure technique.



Fig. 5. Bone removal from floor and anterior wall of the osseous meatus approaching the dome of the jugular bulb. Sulcus tympanicus intact. Note that bone removal is anterior to vertical line drawn through posterior meatal wall so as to avoid the facial nerve.

Our fourth operated case when first seen had almost an identical early tumor that occupied the inferior two-thirds of the tympanic cavity; however, she delayed operation three months, during which time the tumor grew appreciably and became adherent to the lower portion of the tympanic membrane. The same hypotympanotomy technique was carried out as in the preceding case, except that the lower involved

edge of the tympanic membrane was removed, a split thickness skin graft being placed against the lower edge of the remaining tympanic membrane and lining the enlarged osseous meatus. Three weeks after operation the ear was healing rapidly, and the hearing was improving when the patient returned to her home in Venezuela.

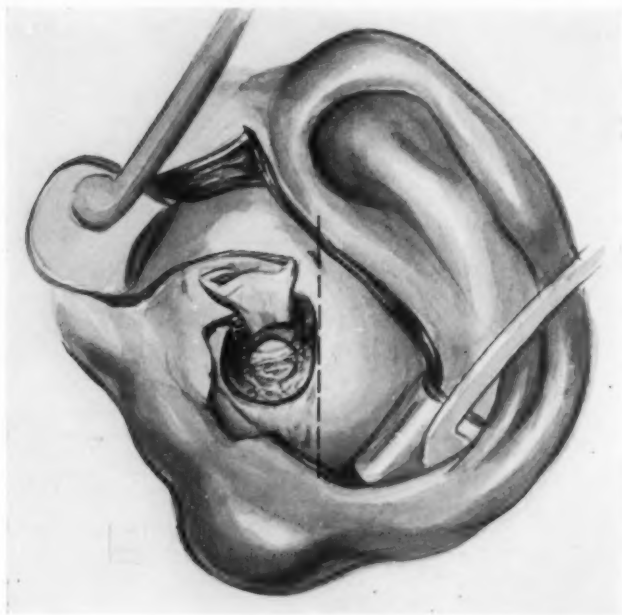


Fig. 6. Sulcus tympanicus has been resected exposing tumor in hypotympanum.

CONCLUSIONS.

1. A primary tumor of the tympanic cavity having the histologic structure of angioendothelioma and arising usually from the hypotympanum or jugular bulb could very well arise from the glomus jugularis structure of Guild, and fall into the classification of glomus jugulare tumor of the middle ear.

2. These tumors are usually slow growing but locally in-

vasive and are not radio-sensitive. Early surgical removal is advisable before the hearing is seriously impaired and important adjacent structures have become involved.

3. For larger tumors radical mastoidectomy with exposure of the hypotympanum, and if necessary the jugular bulb, will permit the tumor to be removed rapidly *en masse* with a minimum of blood loss. The patient should be typed, and blood on hand for transfusion; but by "removing the patient from the tumor" leaving the latter *in situ* until fully exposed, the blood loss has not necessitated a transfusion in any of the author's cases.

4. The technique of hypotympanotomy is described for removal of early glomus jugulare tumors confined to the hypotympanum and tympanic cavity, so as to gain adequate exposure of the tumor without sacrificing the hearing. This approach to the tympanic cavity has not been described before, although Rosen¹² suggested that "in cases where the tumor arises from the promontory it might be possible to excise the entire tumor" by simply elevating the tympanic membrane, while Brown¹⁴ mentions that "it may be possible to remove a small hypotympanic tumor through an incision in the floor of the external auditory canal, whereby the lower half of the drum membrane could be turned up and the tympanum exposed."

Brown notes that with this technique "poor visibility would be the greatest deterrent." With this statement I would agree, for the profuse bleeding attending removal of these tumors requires sufficient exposure to see all of the tumor clearly before removal is begun, and to introduce a good size suction tube, and, if necessary, electrocoagulation, to control the bleeding, both of which would be exceedingly difficult through the normal size meatus.

Naturally the preservation of hearing should not be at the risk of incomplete removal of tumor. If the surgeon finds that hypotympanotomy does not fully and adequately expose the tumor he should not hesitate to proceed with the radical mastoidectomy through the same endaural incision.

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SUBACUTE THYROIDITIS.*†

FRANCIS H. MCGOVERN, M.D.,

Danville, Va.

The nature of this paper is to call to the attention of the otolaryngologist the manifestations of subacute thyroiditis, and to note how the impact of the newer methods of treatment has affected its management. Although the general literature contains many substantial studies on the varied facets of thyroiditis, the otolaryngological literature is singularly free of references to this disease.

Subacute thyroiditis is a clinical entity apparently being seen with increasing frequency in laryngological practice. With the exception of some of the congenital anomalies of the thyroid, the otolaryngologist generally regards the diseases of the thyroid gland to be in the province of the internist and the surgeon; however, because of the nature of his symptoms, the patient with subacute thyroiditis often consults the otolaryngologist first, and unless he is acquainted with the disease the diagnosis will be missed.

Subacute, granulomatous or giant cell thyroiditis (de Quervain's disease) is currently regarded as a non-suppurative, non-bacterial inflammation of the thyroid gland. It is a self-limited disease, sudden in onset, often following an upper respiratory infection, and lasting several weeks to several months; it affects females more frequently than males and usually occurs in the fourth or fifth decades.

The disease varies in severity, manifesting itself often as a mild painful swelling of the thyroid gland, and at times as a severe illness characterized by high fever and prostration. The cardinal symptom, as described by the patient, is a sore throat and pain on swallowing; the pain is often referred to

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† From the Department of Otolaryngology—University of Virginia Hospital.

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the angle of the mandible and to one or both ears, and the dysphagia may be pronounced during the early part of the disease.

The thyroid gland is tense, diffusely enlarged, and one lobe or the other, or the isthmus, is the seat of the pronounced tenderness on palpation. The tenderness may migrate, or may extend from one lobe to the entire gland. All too often in laryngology, routine palpation of the neck is confined to the cervical, post cervical and laryngeal regions, and the thyroid and supraclavicular areas are neglected. The examination of the pharynx and larynx is negative, although the patient may feel that the initial pain is localized in the pharynx. It has been stated that the patient often cannot tell the difference between a sore throat and a sore thyroid gland.

The constitutional reaction is variable. In some cases the patient complains of some transitory generalized aching and fever, often described as an upper respiratory infection; in the severe cases the symptoms are considerable and may last for several weeks. The initial febrile period usually lasts from five to 12 days.

There is an elevation of the white blood count, and the sedimentation rate is significantly lengthened. The pulse rate is higher than the temperature would indicate. The basal metabolic rate and plasma cholesterol level is within normal limits. The serum protein-bound iodine is normal, indicating a normal secretory activity of the gland, although this figure has been found elevated during the acute phase. There is a very low uptake by the thyroid gland of radioactive iodine. The uptake of iodine rapidly returns to normal after remission of the disease.

An occasional patient presents symptoms of tachycardia, sweating, and nervousness which suggest hyperthyroidism. In these cases the I^{131} uptake is especially useful, because it is always decreased in cases of thyroiditis. A few of the patients may develop definite myxedema two or three months after the acute stage, and require replacement therapy with thyroid. Recently Sheets¹ reported an unusual case of thyrotoxicosis four months after complete recovery from acute thyroiditis.

The course of the thyroiditis is irregular; in the mild type the symptoms may disappear spontaneously in a few days; in the severe type, the course may be prolonged even after X-ray and other therapy. The dramatic response to hormonal therapy not only shortens the progress of the disease but also assists in the differential diagnosis.

The microscopic sections of cases of subacute thyroiditis show a picture characterized by cellular infiltration, connective tissue proliferation and giant cell tubercles.

The etiology is unknown. Despite the occasional report of some improvement following the use of antibiotics and the removal of foci of infection, the disease is probably not bacterial. Bacterial cultures of these glands are negative. Thyroiditis has been considered to be caused by bacterial toxins originating in the pharynx, based on the presumption that the disease appeared to follow an acute upper respiratory infection. Frazier and Harrison² and others have suggested a virus etiology; Lindsay and Dailey³ mention the possibility that the lesions seen on histological section might be reactions of hypersensitivity.

The treatment of subacute thyroiditis has been especially successful since the advent of Cortisone and ACTH. Many articles in the recent literature report the prompt and dramatic response to the administration of these agents. Clark, Nelsen, and Raiman⁴ found that a single daily dose of 25 mg. of Cortisone for 12 - 14 days resulted in a relief of symptoms in 24 hours, and the gland was restored to normal size and consistency within two months.

Crile and Schneider⁵ administered 100 mg. of Cortisone daily with prompt improvement in the patient's symptoms and size of the thyroid gland. Lasser⁶ used injections of Cortisone acetate 100 mg. daily in four divided doses, slowly decreasing the dosage and extending the period of treatment by the oral route for a total of 26 days. Cutler⁷ successfully used 40 units of ACTH gel daily for four days, and 20 units on the fifth day in one case, and a larger initial dose (80 u.) on a second case. It has been advised to continue Cortisone treatment until the sedimentation rate reaches a normal level.

Subacute thyroiditis can be successfully managed by X-ray therapy or the use of thiouracil.⁸ Crile and Rumsey⁹ used 100-150 r. daily for one week with splendid symptomatic relief and decrease in the size of the thyroid gland. A course of external radiation of 500-1500 r. is generally considered to be of great value in bringing about subjective and objective improvement.

In Crispell's¹⁰ experience many cases recur after discontinuing Cortisone or ACTH. He advises a trial with X-ray therapy first and uses Cortisone only for symptomatic relief. He has found that X-ray therapy may give satisfying results in 24-48 hours. In one of his cases of thyroiditis using Cortisone the patient became worse and the gland became more tense. It became evident that the process was a suppurative thyroiditis and antibiotics and surgical drainage were necessary.

In the acute case, bed rest, together with the use of local heat treatment and the appropriate analgesic is necessary. The sulfonamides and antibiotics are of no value.

Because it is a self limited disease, treated effectively by medical means, thyroidectomy is not indicated. Surgical intervention has been done when the persistent pain suggested a hemorrhage into an adenoma, when a neoplasm was suspected or from symptoms resulting from thyroid pressure. Therapeutic trial with ACTH or Cortisone or needle biopsy should clear any doubt in diagnosis.

The following case reports illustrate the varying degree of severity of subacute thyroiditis:

Mr. O. H., age 27, consulted me regarding a persistent sore throat of ten days' duration. He complained of painful swallowing and earache on the right side. A colleague had been unable to explain the cause of his discomfort. Examination of the ears, nose, throat, and larynx was negative. Palpation of the thyroid gland showed a very tender, tense, slightly swollen right lateral lobe. He was afebrile; the sedimentation rate, blood count and Wassermann tests were normal. He was given 40 u. ACTH gel for three successive days with complete remission of the inflammatory process and relief of his symptoms.

Mrs. H. G., age 35, complained of sore throat and pain on swallowing of three weeks' duration. She had been under the care of another physician for "ulcers of the throat," and was dissatisfied with her progress. Examination showed a normal appearing upper respiratory tract. She presented, on palpation, an exquisitely tender, diffuse enlargement of the

thyroid gland. She complained of generalized aching and malaise, and her oral temperature was persistently elevated 1° above normal. The sedimentation rate was 25 mm. in one hour and the white count was elevated to 16,400; the serology and urine analysis was negative, hematocrit was 44 per cent, and chest X-ray report was negative.

Her response to ACTH gel (40 u. daily for four days, 20 u. daily for six days) was prompt; on the second day of treatment she noted a subsidence of her symptoms, the gland became less tender and swollen, and she proceeded to a satisfactory recovery.

Mrs. E. C. complained of painful throat symptoms for several weeks before the enlarged, tender thyroid gland was recognized as the source of her trouble. Inasmuch as she was seen before the days of hormonal therapy, she was treated by X-ray therapy without relief of her pain. Her course became quite stormy, with severe constitutional symptoms. Because of her unsatisfactory progress and the extent of thyroid gland involvement, she was admitted to the University of Virginia Hospital seven weeks later.

Examination on admission showed a well nourished and developed 48-year-old woman. Her chief complaints were sore throat, difficulty in swallowing and tender swelling over the front lower portion of her neck. The positive findings were slight obesity, carious teeth and 2+ enlargement of the thyroid gland. Her temperature, 101° F., BP 139/75, and sedimentation rate 35 mm. in one hour. Her urine was normal in all respects, the blood picture was as follows: Hb 11.5 gm., R.B.C. 3.6, Hematocrit 35 per cent, W.B.C. 10,400. The X-ray of her chest was negative; the tuberculin test 1-100,000 negative, 10,000+. The I^{131} uptake was 2.5 per cent in 24 hours, a low figure consistent with the diagnosis of thyroiditis. She was given further X-ray therapy. The process gradually subsided, and there has been no recurrence to date.

The differentiation between subacute thyroiditis and the forms of chronic thyroiditis from a clinical point of view is not difficult. It is currently customary to divide thyroiditis into three types: 1. Subacute thyroiditis; 2. Struma fibrosa of Reidel, and 3. Struma lymphomatosa or lymphocytic thyroiditis of Hashimoto.

Reidel's struma is a painless, hard, non-toxic enlargement of the thyroid gland. The etiology is unknown. There is no tenderness or fever. The symptoms of tracheal pressure predominate: paralysis of the recurrent laryngeal nerve occurs. The important feature of Reidel's thyroiditis is the hard enlargement of the gland and the fibrosing inflammatory process of one or both lobes extending to involve the neighboring structures in an adherent mass. The differential diagnosis from cancer of the thyroid is often difficult. The histological picture is that of a dense diffuse plasma cell and lymphocytic infiltration and fibrosis. The treatment is surgical.

Struma Lymphomatosa of Hashimoto and Lymphocytic thy-

roiditis is a painless, symmetrical progressive enlargement of the thyroid gland. The gland is firm and irregular, and may simulate an adenomatous goitre without hyperthyroidism. The basal metabolic rate is variable and the sedimentation rate is within normal limits. The disease occurs in women beyond the age of 40 but may be seen in younger girls. Gribetz¹¹ et al., reported six cases of non-toxic goitres in girls who were found to have lymphocytic thyroiditis; their diagnosis was made by surgical exploration and by biopsies obtained with the aid of the Silverman needle. The radioactive iodine uptake in Hashimoto's thyroiditis is 43-62 per cent of the tracer dose; the serum protein-bound iodine concentration is not consistent and may be normal.

The pathological section shows a dense infiltration of the gland with lymphocytes and formation of lymph follicles with germinal centers. Crile differentiated Hashimoto's struma from lymphocytic thyroiditis by the absence of acidophilic degeneration of the epithelium.

The treatment of Hashimoto's disease is surgery for those exceptional cases with symptoms of tracheal pressure. X-ray therapy, or the administration of U.S.P. thyroid will successfully control the thyroid enlargement. In those rare cases of unusual enlargement of the thyroid gland resulting from lymphocytic thyroiditis, producing the superior vena caval syndrome, as reported by Sholl and Black,¹² surgery is imperative.

COMMENT.

Crile¹³⁻¹⁴ has written that there has been a progressive increase in the incidence of subacute thyroiditis, due perhaps to better recognition. He and Rumsey classify subacute thyroiditis into two types: 1. The acute fulminating type, and 2. a chronic type, in which the fever, pain, tenderness, and systemic symptoms are minimal. In laryngological practice, in my experience, the diagnosis of mild to moderately severe cases is often overlooked; these cases are treated under the guise of a variety of ear and throat conditions. Indeed a tonsillectomy has been reported to have been performed because of a supposed chronic sore throat.

There is general acceptance of the clinical concept that the three varieties of thyroiditis mentioned are separate and distinct entities. There is no agreement among pathologists on this score. Baker¹⁵ has reviewed the views of those who contend that Reidel's and Hashimoto's struma are separate pathological entities, and those who believe the two conditions are different manifestations of the same process. He reported two cases presenting the microscopic findings of both diseases combined.

Needle biopsy as an aid in diagnosis in thyroiditis has been advocated by Crile in the doubtful cases. In subacute thyroiditis the diagnosis is most often clinically evident, and a prompt response to Cortisone or X-ray therapy will confirm the impression. In those cases in which carcinoma is suspected, surgical exploration and biopsy is preferable. In lymphocytic thyroiditis the needle biopsy will find its greatest usefulness.

As pointed out by Perry¹⁶ the mechanism of the action of Cortisone and ACTH on the thyroid function is uncertain. By radioactive iodine uptake and protein-bound iodine studies it has been shown that a depression of thyroid function is produced by ACTH and Cortisone. This factor plus the general suppression of the inflammatory reaction is supposed to bring about the response to this form of therapy.

CONCLUSION.

Attention is called to the importance of subacute thyroiditis in clinical otolaryngology and the successful use of Cortisone, ACTH, and X-ray therapy in its management. The otolaryngologist should be aware of the characteristics of subacute thyroiditis; sore throat, difficulty in swallowing, a tender tense enlargement of the thyroid gland, an increased erythrocyte sedimentation rate, a marked depression of the uptake of radioiodine by the thyroid gland, and a normal or increased concentration of protein-bound iodine in the serum.

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AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY HOME STUDY COURSES.

The 1955-1956 Home Study Courses in the basic sciences related to ophthalmology and otolaryngology, offered as a part of the educational program of the American Academy of Ophthalmology and Otolaryngology, will begin on September 1, and continue for a period of ten months. Detailed information and application forms can be secured from Dr. William L. Benedict, the executive secretary-treasurer of the Academy, 100 First Avenue Building, Rochester, Minnesota. Registrations should be completed before August 15.

LYMPHOBLASTOMA IN OTOLARYNGOLOGY.*

DELMAR F. WEAVER, M.D.,

Detroit, Mich.

The purpose of this paper is to consider the factors involved in the diagnosis and handling of patients with lymphoblastoma by the otolaryngologist. The term in this paper refers to lymphosarcoma and Hodgkin's disease. Since specific treatment is chiefly in the realm of the roentgenologist and internist, only the general factors in its treatment will be considered.

Since so much attention has been given to metastatic cancer of the cervical lymph nodes in recent years, it is at first surprising to find that there are relatively so few articles in the literature dealing with primary cancer; however, this is easier to understand when one becomes aware of the extreme diversity of its characteristics, its almost 100 per cent rate of fatality, its relatively infrequent occurrence and the fact that so little progress has been made in its treatment since Hodgkin¹ first described one form of it in 1832.

Few clinicians have an opportunity to see a large number of cases from onset to termination. Most private practitioners see a few cases, and a few institutions see a relatively large number; but the overall experience in the disease is not nearly so great as it is in most other forms of cancer.

A review of the medical literature for the past 25 years indicates that the extranodal local lesions are relatively rare.

New and Childrey² reported 32 cases of lymphosarcoma of the tonsil and pharynx that had been diagnosed at the Mayo Clinic. These constituted 14.55 per cent of 220 cases of cancer in this region.

Sugarbaker and Craver³ reported the results of a study of

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196 cases of lymphosarcoma with biopsy. In one-third the primary disease arose in the region of the head. The majority of these were in the tonsil or nasopharynx.

Catlin⁴ reported that 40 per cent of his cases of lymphosarcoma of the head and neck involved the tonsil.

A list of reports of one or two cases of extranodal lesions in the field of the otolaryngologist follows:

Lymphosarcoma of the tonsil was reported by Hirst;⁵ two cases, Morwitz⁶ in a three-year-old child, and Young and Price⁷ bilateral involvement in a 69-year-old diabetic.

Noyer⁸ reported its presence in the left pharyngeal wall of a seven-year-old boy. This tumor was resistant to Roentgen therapy.

Involvement of the mouth was reported by Christiansen⁹ in a child who died eight weeks after onset. The tumor involved the mandible and right maxilla, and had protruded from the mouth after filling it.

Darlington and Leftkowitz¹⁰ reported the death seven weeks after first symptoms of a seven and a half-year-old child with involvement of the upper jaw.

Penhale's¹¹ case died seven months after first involvement of the right mandible, which produced numbness of the lower lip.

In Fanale and McCauley's¹² case there was involvement of the soft palate with associated involvement of the cervical nodes.

Freedman,¹³ of the hard palate. He found only one other case of primary involvement of the hard palate.

Johnson, Stenstrom and Waldron,¹⁴ multiple lesions involving the left lower jaw, right cheek, floor of mouth and the left side of the hard palate.

Hecht,¹⁵ the left upper jaw became involved after involvement of the cervical lymph nodes.

Involvement of the maxillary antrum was reported by

New,¹⁶ whose case was alive and well 12 years after internal and external radiation.

Sugarbaker and Craver³ mentioned one case of involvement of the antrum.

Harper's¹⁷ case originated in the left ethmoid sinus.

Arons¹⁸ reported that of his own 60 cases of cancer of the larynx, one was lymphosarcoma. In a review of the literature he found that 5 per cent of all malignancies of the larynx were lymphosarcoma.

Miller, Dominquez and McCall¹⁹ reported a case with double primary malignant tumors of the larynx. One, a squamous cell carcinoma of the right vocal cord, the other a Hodgkin's sarcoma of the right ventricle.

Schlemenson and Caceres²⁰ reported a case of generalized lymphosarcoma with localization in the larynx. There was a concomitant lymphatic leukemia. They found four reports of lymphosarcoma of the larynx in the literature.

Cooke²¹ reported hoarseness from an ulcerated nodule on the left vocal cord as the first symptom of Hodgkin's disease. Microscopically it was found to be infiltrated by the disease. The cervical and axillary lymph nodes became involved later.

Linn²² reported a case of hoarseness from pressure of mediastinal nodes involved by Hodgkin's.

Mannino²³ reported a case of lymphosarcoma of the parotid gland seen and operated upon at the surgical clinic of the University of Palermo. Sugarbaker and Craver³ referred to one such case.

Oppikofer²⁴ reported infiltration of the right mastoid by extension from an involved cervical node.

Wrong²⁵ reported involvement of the scalp of a 12-year-old boy by Hodgkin's disease. He was well four years later.

Bickel²⁶ found a tumor of the esophagus 28 cm. from the teeth which proved to be Hodgkin's disease.

Shebesta²⁷ reported a case of gangrene of the face produced by lymphosarcoma.

In 59 per cent of the cases reported by Sugarbaker and Craver² the primary lymph node involvement was in the neck. Since a study of the lymph nodes of the body in general indicates that those of the neck constitute about 15 per cent, this may suggest that the etiology is in some way influenced by the anatomical location of the nodes. This is especially true, since the cervical nodes are most exposed to the external environment.

The lymph node involvement is most inconsistent in all respects, and there is a wide variety of circumstances associated with the involvement. One patient may notice a large supraclavicular node, while taking a shower, as first evidence of the disease. In another a number of discrete nodes extending throughout any of the several chains may be enlarged. Another may have one or two small, firm palpable submental nodes, while still another has a single enlarged node that appears suddenly and incompletely subsides. There may be recurrences of this before one becomes suspicious of the presence of lymphoblastoma. The lymphadenopathy may or may not be associated with fatigue, loss of weight, backache, fever or sore throat.

Certain adults tend to have relative enlargement of the lymph nodes of the body without ever developing any evidence of associated serious disease. It may at times be advisable to remove one or more of these nodes for microscopic examination. The almost universal lymphadenopathy of moderate degree in children associated with upper respiratory infection needs no further comment.

While the blood picture in lymphoblastoma is usually within normal limits, it may be confused with mononucleosis, and it is at times advisable to remove a node for biopsy from a patient who has a history of mononucleosis. The author has recently removed an enlarged superior deep cervical node from a 21-year-old girl who had mononucleosis several years ago, and for the past year had had recurring sore throats with associated swelling of the node. Her plan to live in Germany forced the decision to remove it. It was negative.

The decision as to whether to remove a node for biopsy may be difficult; however, if one who has gained experience from

examining large numbers of normal and abnormal necks is suspicious for the presence of cancer, biopsy is justified.

When biopsy is done it is advisable to obtain as much tissue for the pathologist as is consistent with good judgment.

Loseke and Craver²⁸ recommend aspiration biopsy in certain cases when the nodes are associated with important structures. This was diagnostically successful in 56 per cent of 25 cases on which it was used as the first method. In the author's opinion, use of the method is quite limited.

The pathological diagnosis of this disease is no less difficult than the clinical evaluation. Even pathologists of wide experience and superior ability and reputation have difficulty at times. In some cases this may be due to the fact that diagnostic features are not present in the tissue presented, but it appears that pathologists may vary in the amount of evidence they must have before making a diagnosis. A pathological diagnosis of "inflammatory involvement" or "lymphoid hyperplasia" is not uncommon when a lymph node has been removed from a patient who later is found to have lymphoblastoma. This is often an unpleasant situation, especially when the clinical evidence is strongly suggestive of the disease.

Heinrich and Judd²⁹ studied the records of 100 consecutive cases in which biopsy was performed on the lymph nodes and found positive results in 78 per cent of the cervical nodes, 60 per cent of the axillary and 33 per cent of the inguinal.

A pathological diagnosis of metastatic squamous cell carcinoma, Grade 4, or transitional cell carcinoma, may be made on a node from a patient who never develops a demonstrable primary tumor. These patients may follow a rather typical course of lymphoblastoma.

The possibility of confusion between these two conditions by the pathologist has been referred to in separate articles by DeJardins³⁰ and Craver.³¹

The author has seen several patients in whom this situation appeared to exist, but it could not be confirmed. In personal communications with pathologists, some have expressed the opinion that the similarity between the two conditions may be

sufficient to allow for confusion while others have disagreed. Jennings³² states that the situation does arise from time to time, and that the lymph node imprint method of determining cell type has been useful.

With few exceptions, lymphoblastoma will respond dramatically to Roentgen therapy, and this may be of considerable value in diagnosis, especially in involvement of the mediastinal nodes. It is unusual for any other tumor to respond so promptly and completely; however, Roentgen therapy as a diagnostic test should be used only in specially selected cases, and after all other diagnostic measures have failed to produce confirmatory evidence.

When a pathologist reports an enlarged lymph node as non-malignant, and the clinician is satisfied with the clinical picture, the patient may be reassured with little reservation; however, if the clinical appearance of the node is suggestive of malignancy and there are other unexplainable clinical features, one should not be too reassuring.

The clinician may recognize immeasurable evidence of the disease based entirely on experience. Consequently, a clinical diagnosis of lymphoblastoma will often prove correct in spite of negative pathological reports.

The manifestations and general course of the disease cannot be predicted in any patient. Some will follow a rapidly declining course terminating in death in a matter of months or a year or two. Others may live 20 or 30 years. Craver³¹ considers early diagnosis and treatment valuable in its course. In a few cases it appears that the disease has been present for many months or even years before it is suspected.

The following cases are reported briefly in an effort to illustrate some of the points made in the foregoing discussion.

Case 1. A 60-year-old man presented an ulcerated tumor of the right tonsil with enlarged cervical lymph nodes on the right. A small biopsy removed in the office was reported as lymphosarcoma. Following irradiation, the cervical node enlargement was much reduced in size, but death occurred within a year from progression of the cancer.

Case 2. A colored man, age 43, was seen first on February 19, 1953. There was a history of swelling of upper left jaw for one month following a tooth extraction. Improvement of symptoms had followed several injections of penicillin, but considerable pain had remained. Roentgenograms

which had been taken 10 days previously showed thickened membrane of the left antrum with evidence of soft tissue swelling overlying the antrum (See Fig. 1).

On February 24 the antrum was opened through the canine fossa and moderate swelling of the mucous membrane noted. A moderate amount of granulation tissue was present. Drainage was instituted and tissue removed for microscopic examination. This was reported as chronic inflammatory reaction in soft tissue and granulation tissue formation. The



Fig. 1. Thickened membrane of the left antrum and soft tissue swelling over the antrum.

swelling and discomfort remained beyond the usual postoperative period, so on March 31st, five weeks later, the tumor measuring 2.5 cm. was removed through an external incision on the cheek. Microscopic examination of this tissue revealed lymphosarcoma.

Response to irradiation was prompt and complete.

On May 8 moderate enlargement of a left supra-clavicular lymph node was noted. This responded promptly to irradiation also.

On June 20 marked localized swelling occurred in the midfrontal region. This, too, responded to irradiation.

October 5, 1954, Roentgenograms of the sinuses showed essentially normal findings, and the patient was free of symptoms (see Fig. 2).



Fig. 2. Normal appearance of left antrum.

Case 3. A white woman, age 56, developed tenderness over the left lower jaw and discharge of pus and sequestration of a spicule of bone from the left lower molar region three months after extraction of teeth. Four months later external swelling developed over the angle of the left jaw. When first seen, two months later, biopsy of a left supra-clavicular lymph node showed Hodgkin's disease. The patient died three years later.

Case 4. A white male, age 29, complained of elevation of temperature in the evening and considerable itching of the skin. Biopsy of a left supra-

clavicular node revealed Hodgkin's disease. Death occurred two years later.

In Cases 3 and 4, and similar cases, diagnosis is not especially difficult because an obviously abnormal node was pres-

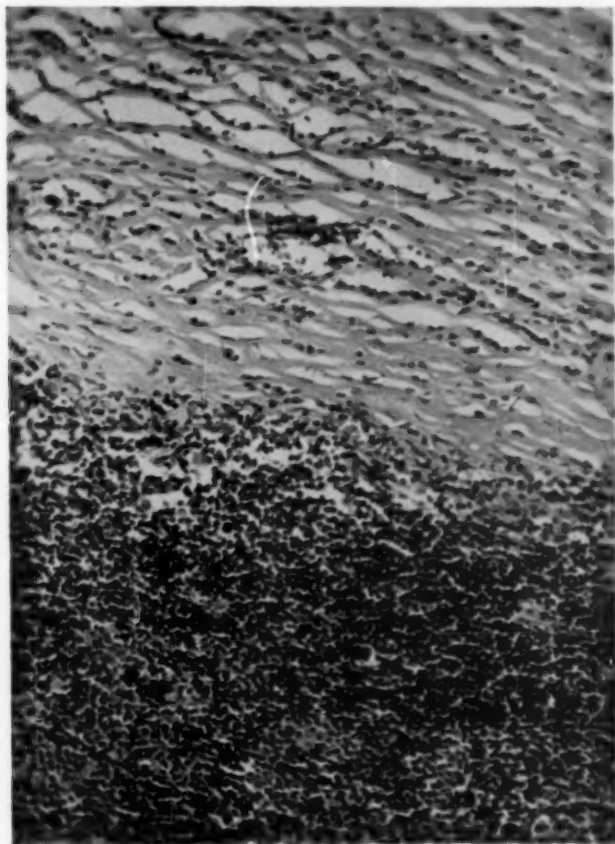


Fig. 3. Lymphosarcoma (x 200).

ent when first seen and diagnosis by the pathologist was prompt.

Case 5. A white man, age 49, developed marked enlargement of one of the superior deep cervical nodes on the right in February, 1952. This subsided considerably but not completely and recurred two months later. The enlargement subsided moderately again, and then recurred about two months later when first seen. At this time it was about 3 cm. in diameter.

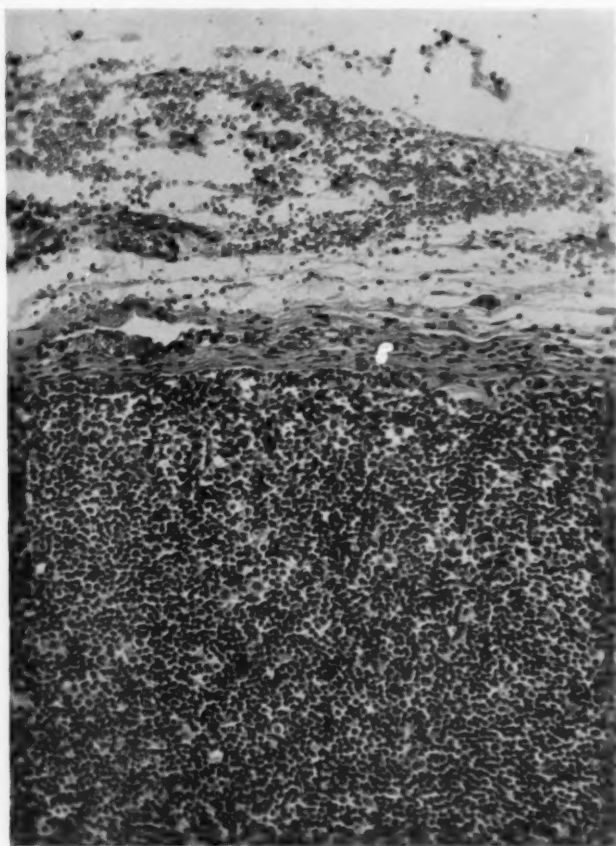


Fig. 4. Lymphosarcoma (x 200).

Four days later it had decreased to about 2 cm. in diameter after injection of penicillin; however, since it failed to decrease in size further, it was removed for biopsy on September 23, 1952. Microscopic diagnosis was lymphoblastoma, reticulum cell type. Since only one node was involved, Roentgen

therapy was deferred. Two months later swelling in the region of the scar suggested recurrence, so Roentgen therapy was carried out.

Two years later there is no evidence of the disease.

Case 6. A white woman, age 49, had developed enlargement of several discrete nodes on the posterior border of the left sternomastoid muscle

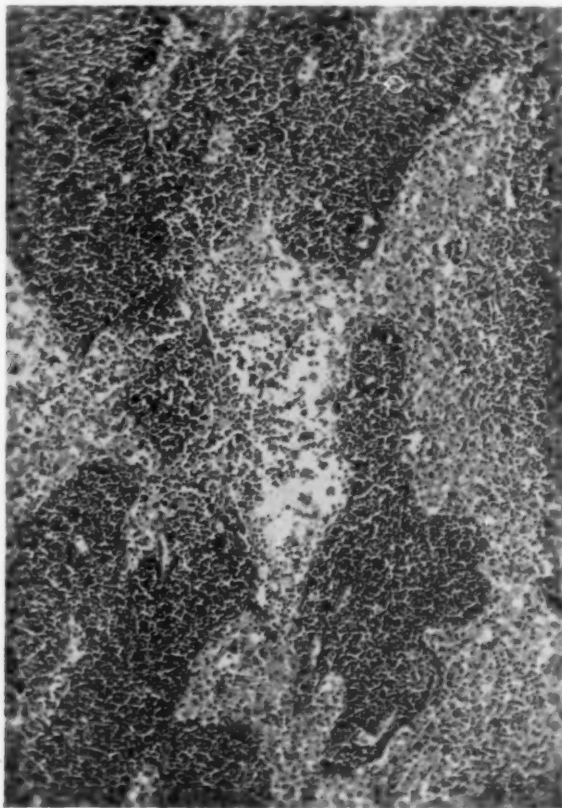


Fig. 5. Giant follicular hyperplasia (x 175).

in November, 1942. Tissue removed by needle biopsy at that time had not shown neoplasm, so the condition was not thought to be important.

In April, 1943, five months later, when first seen, the most suitable

lymph node was removed for biopsy. The report of the microscopic examination was lymphoid hyperplasia. Following Roentgen therapy the remaining nodes subsided promptly.

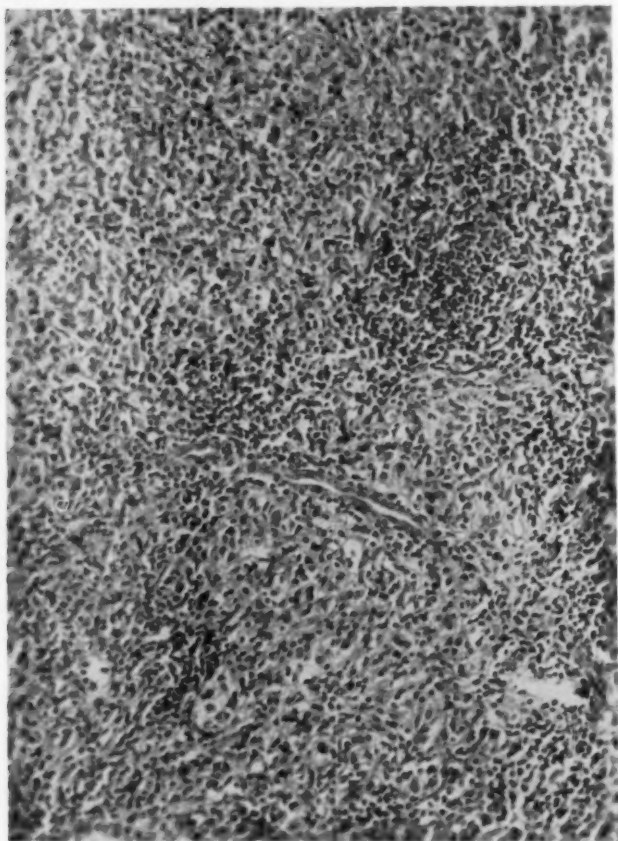


Fig. 6. Metastatic Carcinoma Grade 4. (Transitional or Lymphoepithelioma Type) (x 200).

Two months later a left supra-clavicular node became enlarged and this responded to Roentgen therapy also. Later, node involvement became more general and the patient died.

The clinical picture was so typical that, in spite of the inability to con-

firm the diagnosis microscopically, it was felt that treatment was justified. In retrospect the importance of having microscopic proof is clearer, since without it, embarrassing situations may arise. On the other hand, however, recent review of the original slide indicates enough evidence to make a diagnosis of lymphosarcoma (see Fig. 3).

Case 7. A white woman was seen first on September 16, 1952. There was a history of weakness, backache and recurring sore throat of two months' duration. There were five discrete lymph nodes about 1.3 cm. in diameter on the posterior border of the right sternomastoid muscle. Two days later all five of these nodes were removed, and a presumptive diagnosis of lymphoblastoma of lymphosarcoma type was made, but could not be confirmed.

Although she developed no other large superficial nodes, she developed a severe cough. Roentgenograms of the chest were negative, so bronchoscopy was carried out on December 8. There was evidence of a mediastinal mass noted.

The patient was never free of symptoms, but a definite diagnosis could not be made. In March of 1954 the patient became ill with severe abdominal pain, and a splenectomy was done without the knowledge of the author. Microscopic examination of the spleen was equivocal also. The patient died before leaving the hospital.

Recent review of the original slides indicates sufficient evidence to make a diagnosis of lymphosarcoma, Hodgkin's type (see Fig. 4).

Case 8. A 63-year-old white man was seen on January 8, 1951. The only significant abnormal finding was two discrete lymph nodes in the submental region from 1½-2 cm. in diameter. These nodes were removed two weeks later, and a diagnosis of giant follicular hyperplasia made. Since this is usually a form of lymphoblastoma in an early stage of development, the likelihood of the presence of a serious disease was immediately considered (see Fig. 5).

During the next 10 months he developed no other findings except slight weight loss. Contact with the patient was lost at this time.

There is recent information to the effect that the patient developed generalized lymphadenopathy and died in August, 1951, 18 months after he was first seen.

Case 9. A 58-year-old white man of Greek extraction was first seen on January 10, 1947. Fifteen months previously he had developed an enlarged lymph node in the left side of his neck. Several months previously the node had subsided following Roentgen ray treatment. On February 13, 1947, there were two enlarged nodes in the left side of the neck just anterior to the sternomastoid muscle. Report of the microscopic examination of one of these nodes contained the statement, "The areas with spindle shaped cells are suggestive of sarcoma, but it is felt that this tumor is a carcinoma" (see Fig. 6). Diagnosis: metastatic carcinoma, Grade 4. The response to X-ray was good on several occasions.

Two-and-one-half years later (1949) he developed enlarged axillary lymph nodes.

In November, 1950, bony metastasis developed, and a compression fracture of the dorsal vertebrae occurred.

In January, 1951, there was infiltration of the pterygo-maxillary fossa with extension of swelling into the left pyriform sinus and the epiglottic area. He died in the summer of 1951, about six years after first symptoms.

It is, of course, possible that this patient had a primary tumor of the pharynx that was sensitive to the original Roentgen treatment, but that is not too consistent with the subsequent course and duration of the disease.

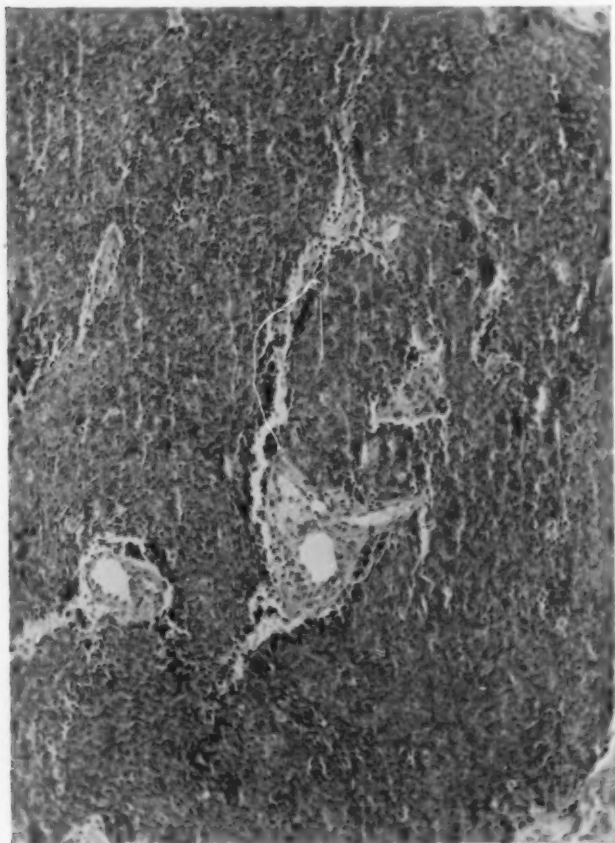


Fig. 7. Metastatic Carcinoma Grade 4. (Transitional or Lymphoepithelioma Type) (x 175).

Case 10. A white woman 67 years old was seen June 15, 1946. There was a history of having had a lymph node removed from the left side of the

neck 12 years previously. Six years previously a swelling appeared at the left angle of the mandible, and several Roentgen treatments had been given.

On the admission examination there was noted enlargement of the left mastoid lymph node. It was soft and tender. This area had also been irradiated five years previously. Sixteen months later, on September 12, 1947, a section of the node was removed. It had suppurated and ruptured through the capsule. The pathological report was transitional cell carcinoma. There was no evidence of a primary tumor in the ear, nose or throat, and general and Roentgenological examinations, including pyelograms, were negative.

In January, 1948, there was Roentgenological evidence of metastatic malignancy of the skull, and one month later there was metastasis to the femur.

The patient died April 25, 1948, with generalized carcinomatosis. The primary site unknown (See Fig. 7).

An attempt has been made to further the interest of the otolaryngologist in lymphoblastoma. From a review of the literature for the past 25 years the relative frequency of the extra-nodal lesions has been recorded.

The factors concerned in the clinical diagnosis and its correlation with pathological reports has been discussed from the standpoint of the management of patients with primary involvement of the cervical lymph nodes.

Brief reports have been made to illustrate the variety of cases encountered by the otolaryngologist.

It is recommended that the otolaryngologist who assumes responsibility in the neck familiarize himself not only with the appearance and "feel" of all varieties of normal necks, but also those involved by tumors. This will be especially advantageous in lymphoblastoma of the cervical lymph nodes when there is no extra-nodal local lesion from which biopsy can be obtained. This experience is also quite valuable when pathological diagnosis cannot be made in the presence of the disease.

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RESTORATION OF HEARING IN OTOSCLEROSIS BY
MOBILIZATION OF THE FIXED STAPEDIAL
FOOTPLATE. AN ANALYSIS OF RESULTS.*

SAMUEL ROSEN, M.D.†

With Technical Assistance of

MOE BERGMAN, Ed.D.‡

New York, N. Y.

Restoration of hearing in otosclerosis by operative treatment has been the most vital contribution to otology in this Century. Lempert's great contribution in fenestration surgery is known to all. In recent years the author has been engaged in attempting to restore hearing in otosclerosis by mobilizing the fixed stapedial footplate. The quest for a simple surgical procedure to restore hearing has led to the development of the technique to be described.

In December, 1952, the author reported¹ his first case of restoration of hearing in otosclerosis treated by this method. The patient (E.L.) was operated upon in April, 1952. Normal hearing resulted in the treated ear and has been maintained to the present (see Audiogram, Case 1). Additional communications^{2,3,4,5,6,7,8,9} with case reports have demonstrated that the procedure developed and employed by the author can mobilize the fixed stapedial footplate and restore useful and sometimes normal hearing.

Ideally, a surgical procedure for otosclerotic deafness should re-establish the normal function of nature's pathway of sound conduction, *i.e.*, 1. An intact and freely mobile ossicular chain

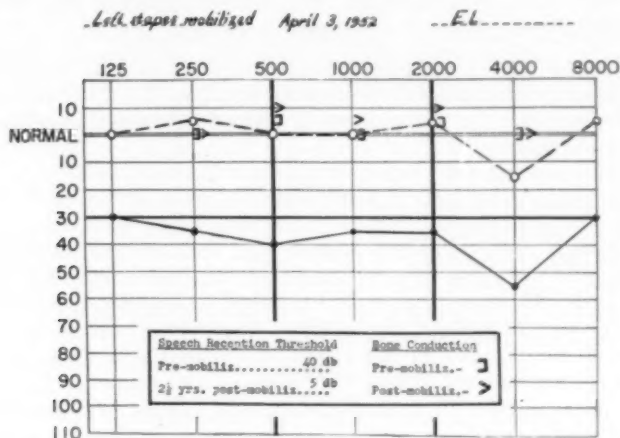
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† Consulting Otologist, The Mount Sinai Hospital, New York, N. Y.

‡ Associate Professor, Audiology and Speech Pathology, Hunter College, New York, N. Y.

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terminating in 2. A freely movable stapedial footplate in 3. Nature's oval window. The technique presented here was, therefore, devised in the belief that hearing would be restored if the fixed stapedial footplate could once again be rendered freely movable.



Case 1. E. L. The solid line indicates the air conduction audiogram for the left ear just before mobilization of the fixed stapedial footplate. The dashed line audiogram shows the threshold for the same ear 25 months after the operation. The speech reception thresholds for the same period are also shown.

In evaluating this procedure, certain key questions must be answered. The main questions are:

1. Can the fixed stapedial footplate be mobilized?
2. If the fixed footplate can be mobilized will this restore hearing, and to what degree?
3. Will hearing restored by this method last?
4. Is the hearing made worse by mobilization?
5. What are the indications for this new procedure?
6. What are the significant features of this technique?
7. Are there complications?
8. What surgical and technical factors contribute to success or failure?

9. What other factors contribute to success or failure?
10. Can improved hearing result from the fenestration operation on the side in which the rigid stapes could not be mobilized?
11. Conversely, can improved hearing result from the mobilization of the fixed stapedial footplate on the side in which the fenestration operation has failed?

The purpose of this communication is to provide a critical evaluation and analysis of results obtained by the mobilization operation in an attempt to answer the questions posed in this paper.

HISTORY.

Kessel¹⁰ in 1876 attempted to improve hearing in stapes ankylosis resulting from suppuration by removing the drum, malleus and incus. Later Kessel tried mobilization and then complete removal of the stapes. Boucheron¹¹ in 1888, reported mobilization of the stapes in 60 cases after separating the incus from the stapes and excising the posterior half of the drum. Miot¹² in 1890 reported good results in a series of 200 cases of stapes mobilization. In some cases he operated the same ear three times within the first few months.

In America, Blake,¹³ Jack,¹⁴ and Burnett¹⁵ (1891-1893) similarly employed mobilization of the stapes, but soon turned to stapedectomy. Faraci¹⁶ in 1899, reported limited success with mobilization. He predicted that a great stride in scientific progress would be made when the technique for stapes mobilization was ultimately perfected. Others attempted various operations to mobilize or extract the stapedial footplate.

Siebenmann¹⁷ in 1900, stated that all operations on the stapes, mobilization or stapedectomy, were useless. *In all these operations the attempt to mobilize the stapes was through a myringotomy.* It may be that in many cases myringotomy did not provide sufficient vision of the stapes to allow precise manipulation. These operations were finally abandoned over 50 years ago in favor of attempts to create a new window into the labyrinth, which has resulted in the present-day fenestration operation of Lempert.

TECHNIQUE FOR MOBILIZATION OF FIXED FOOTPLATE OF
STAPES (ROSEN).

The operation is performed under local anesthesia through an ordinary ear speculum in the external auditory canal, using the Zeiss-Cameron loupe. One to two cc. of mixture of three parts 2 per cent Xylocaine and one part adrenaline chloride 1/1000 is injected subcutaneously into the skin of the posterior wall, roof, anterior wall and floor at the junction of the cartilage and bone.

An incision is made through the skin over the bony canal wall 6 to 7 millimeters external to the drum, beginning postero-superiorly at the point of junction of the pars flaccida and pars tensa of the drum. (It is always best to begin the incision higher rather than lower). The incision is carried downward along the posterior wall, floor, and anterior wall as far as the point where the pars tensa and flaccida meet antero-superiorly (see Fig. 1).

The skin is separated from the bone as far as the edge of the drum with instruments Nos. 2 and 3 (previously used by Lempert in tympanosympathectomy) starting the separation at the beginning of the incision. The tympanum is first entered about a millimeter or two below the beginning of the incision. From this point of entry into the tympanum, the drum is progressively lifted out of its sulcus. It is reflected upward upon itself like an apron with the instrument No. 4. This is essentially the same approach to the tympanum as that used by Lempert in his tympanosympathectomy operation.¹⁸

In over 85 per cent of the cases, more or less of the incudo-stapedial joint is seen at once. The stapes, however, cannot be seen sufficiently to allow safe manipulation; therefore, about two to three millimeters of the very edge of the posterior bony canal just external to the incus and stapes must be removed with instrument No. 5 in order to get a full view of the long process of the incus, the incudo-stapedial junction, the head, neck, sometimes the crura and the footplate of the stapes, facial canal, the entire length of the stapedius tendon,

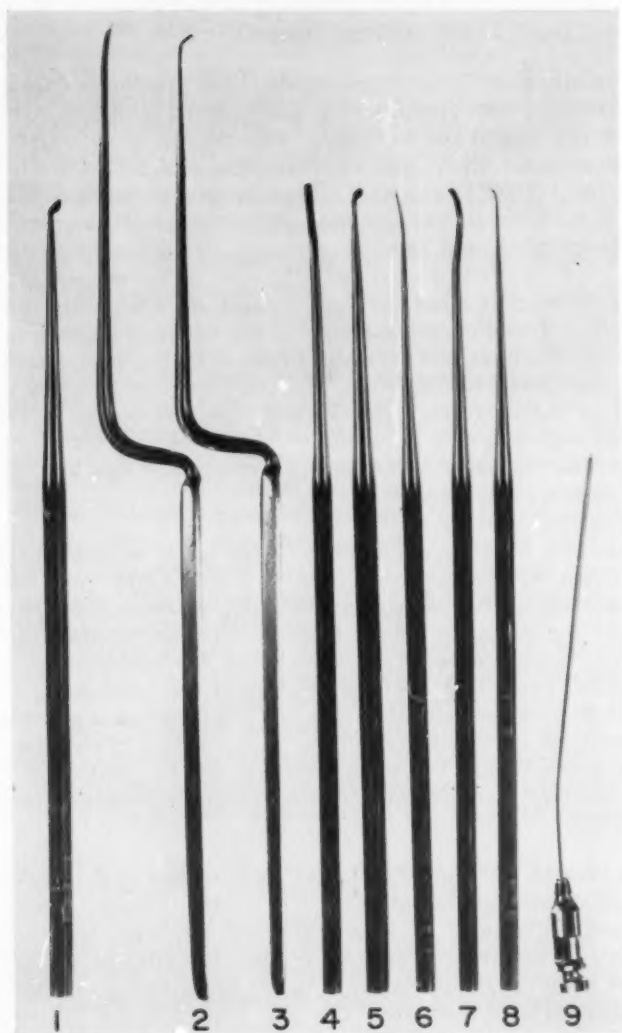


Fig. 1. Instruments numbered in the order in which they are used in mobilization of the stapes.

chorda tympani nerve, a portion of the incudo-malleolar articulation and the inner aspect of the hammer handle.

To test for mobility of the footplate of the stapes, a finely pointed probe (instrument No. 6) is placed against the long process of the incus close to its articulation with the stapes and moved gently downward for a distance of about a half-millimeter (see Fig. 2). When the normal footplate of the stapes is freely movable in the oval window, the gentlest

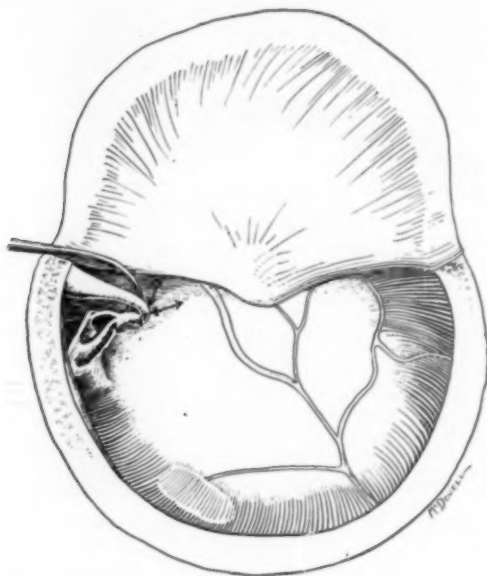


Fig. 2. Drum and skin are reflected and a wide exposure of the long process of the incus, stapes and stapedial tendon is made after the edge of the bony canal wall is removed. Palpation is then made to determine stapedial fixation.

pressure of the probe against the long process of the incus causes free and unimpeded movement of the incus, the incudo-stapedial joint, the head, neck, crura of the stapes and stapedial tendon. The tendon of the stapedius is the structure to watch at all times, since its movement is the reflection of the footplate movement. The footplate of the stapes moves

invariably whenever the head and crura move, and when this happens the tendon invariably moves in proportion to the movement of the stapes.

These structures can all be seen to move together as one. The operator can also feel these structures moving. This associated sight and feel must be experienced often to master the technique. When the stapes is partially or incompletely fixed,



Fig. 3. Pressure of mobilizer (instrument No. 7) against the neck of the stapes mobilizes the footplate without violating the incudo-stapedial joint.

it takes greater pressure of the probe against the long process of the incus to move the above structures even slightly, as measured again by the degree that the tendon can be seen to shorten and lengthen. Again, these structures can be seen to move together as one, however minutely; but when the footplate of the stapes is completely fixed, very firm pressure of the probe against the long process of the incus causes the incus alone to move, but there is no movement whatever of the head, crura, footplate or tendon of the stapes.

When the stapes is rigidly fixed (stapes removed from cadavers and fixed in cement offer good practice to get the feel of the otosclerotic rigid stapes) variable pressure downward against the neck (only the neck, because it is the thickest and strongest part of the stapes) may suddenly loosen the footplate with immediate improvement in hearing. For this purpose a specially curved, narrow mobilizer was devised (instrument No. 7). The palpating edge of the mobilizer is first inserted over the incudo-stapedial joint and is carried inward until one can feel the anterior crus of the stapes close to the footplate. The instrument is pulled gently upward and outward hugging the anterior crus until one suddenly feels a dent or depression, which is the neck of the stapes. At this point the stapes withstands the greatest pressure without fracture of the crura (see Fig. 3).

Pressure downward in the line of the stapedial tendon is made until the stapes is mobilized. The direction of the stapedial tendon roughly follows the same direction as the crura and the long axis of the footplate; however, when one or both crura can be seen, the direction of the pressure against the neck of the stapes is in the line of the crura. Very slight pressure laterally against the neck of the stapes may help to mobilize it (see Fig. 2). The amount of pressure which can be exerted on the neck of the fixed stapes without fracturing the crura is considerable.

If during the procedure adhesions or granulations involving the ossicles or round window are encountered, they may be dealt with, (using instrument No. 8). A rounded and slightly bent spinal tap needle is used for suction (instrument No. 9). When the operation is finished, the drum, and the attached skin of the external auditory canal are placed back in their original positions. The ossicular chain remains intact.

It is my conviction that generally procedures of this kind should be performed only by those skilled in endaural surgery. For the mobilization operation even the skillful surgeon should perform the operation on at least 50 fresh cadavers before the first patient is operated upon. This number seems to be the minimum required, because of the great number of

anatomical variations. One must learn to do the operation skillfully through external auditory canals which are wide, narrow or tortuous. Also in many specimens the posterior bony canal wall is concave, and the anterior canal wall is convex. Separating the skin from the bony wall without tearing it or injuring the drum in such cases is difficult and should be learned on the cadaver.

This operation appears deceptively simple, yet learning to perform it skillfully is not, because all maneuvers are restricted by the limits of the bony external canal. In early cadaver practice all canals seem quite narrow. To some this is an unfamiliar approach to intratympanic surgery.

Personal communications to the author of some of the early results of the operation performed by others in the living might indicate insufficient practice on the cadaver.

Can the Fixed Stapedial Footplate Be Mobilized?

When pressure against the neck of the rigid stapes is suddenly accompanied by improved hearing, it can be inferred that the rigid footplate has been mobilized. When this occurs the visible portion of the stapes and its attached tendon can be felt and seen to move together. On the other hand, when the pressure against the neck of the stapes causes it and the attached stapedial tendon to move very freely, but the hearing does not improve at once, it must be inferred in most cases that a fracture of the crura has occurred (sometimes with an audible crack) leaving the footplate fixed. Crural fracture seems to be the most common cause of failure in this procedure. In the author's experience it is difficult in many cases to discriminate between a mobilized footplate and fractured crura, since in both the stapedial tendon moves on palpation of the long process of the incus.

When a drop of saline solution is placed in the round window niche and the mobilized stapes is moved back and forth at its neck, a light reflex can sometimes be seen of this fluid moving in the round window niche. The movement of the saline solution in the round window niche is the result of the pressure transmitted through the cochlea from the movable stapedial footplate. This is seen best with the microscope.

If the Fixed Footplate of the Stapes Can Be Mobilized Will This Restore Hearing, and to What Degree?

The answer to this question can best be determined by a critical analysis of the positive and negative results in all patients who had the mobilization operation for otosclerotic deafness. In every case reported the stapes was found to be fixed. The data in this report are based on 211 consecutive cases operated on between April, 1952, and August, 1954. This includes every patient with otosclerosis who had the mobilization operation during this period. Seven of these patients were from the Otolaryngological Service at the Mount Sinai Hospital, and the rest were private patients. In order to apply a rigid statistical evaluation in reporting results of this new procedure, all cases in which available data were insufficient for analysis are counted here as failures.

TESTS, TEST AREA, EQUIPMENT AND PERSONNEL.

In all cases, routine tests of hearing for the diagnosis of otosclerotic deafness included pure tone air and bone conduction threshold audiometry, speech reception thresholds using spondee words, speech discrimination scores using PB words, and tests for tolerance levels to spondee words and white noise. Where indicated, recruitment tests were done to differentiate cochlear from middle ear deafness.

All tests, both pre- and post-operative, except those on hospital service cases, were performed in rooms in which the ambient noise level measured on the "A" scale of a General Radio 1551-A sound level meter was between 35 and 40 db.

Two pure tone audiometers were used, an Audivox 7-B and a Peters SPD-2 (Sonotone Model 23), the latter with a Sonotone bone oscillator. The air and bone reference levels were checked periodically on subjects with normal hearing. Speech audiometry was performed by feeding tape-recorded spondee and PB word lists from Pentron Model PBA-2 tape players through the pure tone audiometers, utilizing the attenuators and earphones of the latter. Threshold calibrations were determined by testing normal listeners.

Two audiologists, Dr. Moe Bergman and Miss Phyllis Fried-

man, and the surgeon, performed the pre- and post-operative hearing tests in random order.

CLASSIFICATION OF CASES.

The cases reported here are divided into four categories, A, B, C and D, based upon the pre-operative bone conduction thresholds.

"A" CASES

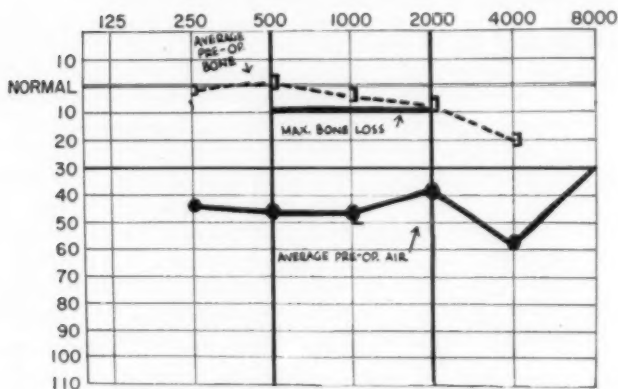


Fig. 5. A Cases. Mean pre-operative thresholds for air and bone in 25 A cases reported here.

A. This includes all cases with pre-operative maximum bone conduction losses as follows:

at 500 cps — 10 db.

at 1000 cps — 10 db.

at 2000 cps — 10 db.

The average pre-operative loss of hearing by air conduction in the speech frequencies for these cases was 43.9 db (see Fig. 5).

B. This includes all patients not included in the *A* category who had maximum bone conduction losses as follows:

at 500 cps — 20 db.

at 1000 cps — 20 db.

at 2000 cps — 20 db.

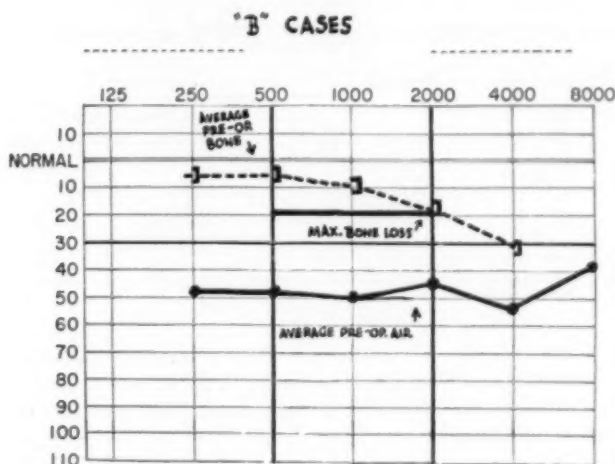


Fig. 6. B Cases. Mean pre-operative thresholds for air and bone in 92 B cases reported here.

The average pre-operative loss of hearing by air conduction in the speech frequencies was 47.5 (see Fig. 6).

C. This includes all patients not eligible for *A* and *B* categories who had maximum bone conduction losses as follows:

at 500 cps — 30 db.

at 1000 cps — 30 db.

at 2000 cps — 30 db.

The average pre-operative loss of hearing by air conduction in the speech frequencies was 54.1 db (see Fig. 7).

C CASES

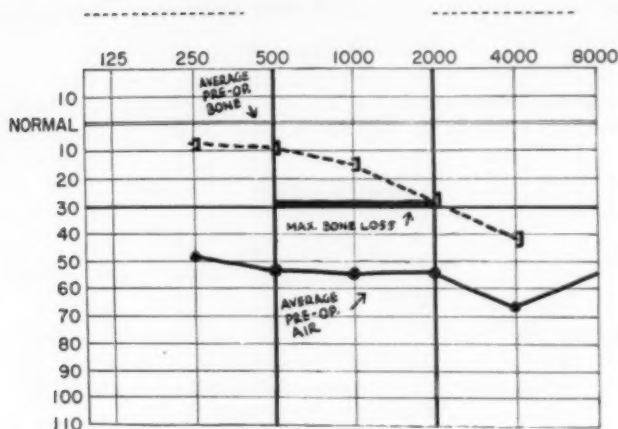


Fig. 7. C Cases. Mean pre-operative thresholds for air and bone in 56 C cases reported here.

D. This includes all patients with pre-operative maximum bone conduction losses greater than 30 db at one or more of the critical frequencies. Thirty-eight such cases were operated on and are reported.

The effect of the operation upon hearing was tabulated by pure tone and speech reception threshold changes, both of which are reported.

A Cases: Twenty-five cases are reported with pure tone and speech audiometry data. Thirteen or 52 per cent of these patients improved 15 db or more over their pre-operative pure tone levels to achieve a hearing level of 35 db or better. Twelve of the thirteen who were improved, or 48 per cent of the total *A* group, reached 30 db or better. Sixteen, or 64 per cent, improved to the 35 db level or better by speech audiometry. The hearing of five in this group reached a post-operative level of 20 db or better by pure tone and speech audiometry, while two patients in this group now enjoy a pure tone level between zero and ten db. Twelve of the 25 reported in this category showed no change of pure tone threshold following the operation, or insufficient gain to reach

the 35 db level. They are listed in the table of Class A patients as unimproved. The post-operative improvement to the 30 db level is shown in order to conform to the standard set by fenestration. The post-operative improvement to the 35 db level is also given, because many patients who reach this level from a profound loss seem to show little impairment of the hearing function.

TABLE I.

Results of Mobilization of the Fixed Stapedial Footplate in A category cases.

Pure Tone Average (500, 1000, 2000 cps)			Spondee Threshold	
Number Reported	25		49.8 db	
Average Pre-Op. Losses	43.9 db		25	
Post-Op. Audiometric Level	No. of Cases	Per Cent	No. of Cases	Per Cent
0-10 db	2	8.0%	1	4%
11-20 db	3	12.0%	4	16%
21-30 db	7	28.0%	7	28%
31-35 db	1	4.0%	4	16%
Total Improved	13	52.0%	16	64%
Unimproved	12	48.0%	9	36%

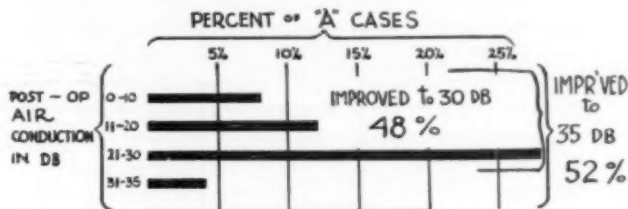


Fig. 8. The graph shows the per cent of 25 A cases showing improvement to the various pure tone threshold levels following mobilization of the fixed footplate of the stapes.

In this category the post-operative periods ranged from three to 30 months, with an average of 15 months between the time of operation and the last post-operative tests.

In those A cases in which the hearing was improved following the operation, the average improvement for pure tones in the speech range (500, 1000, 2000 cps) was 24.0 db. The average post-operative level was 19.7 db. The average spon-

deed gain was 22.1 db. The average improvement at each frequency is shown numerically in Table II and graphically in Fig. 9.

TABLE II.

Comparison of average pre-operative and post-operative pure tone levels in 13 improved A cases.

	Frequency						Average (500- 2000)
	250	500	1000	2000	4000	8000	
Pre-Op. Level (db)	43.8	45.9	46.9	38.5	50.8	30.9	43.7
Average Gain (db)	25.5	27.1	24.6	20.4	14.0	14.3	24.0
Post-Op. Level (db)	18.3	18.8	22.3	18.1	36.8	15.7	19.7

***A* CASES AVERAGE AIR LEVELS
BEFORE AND AFTER MOBILIZATION**

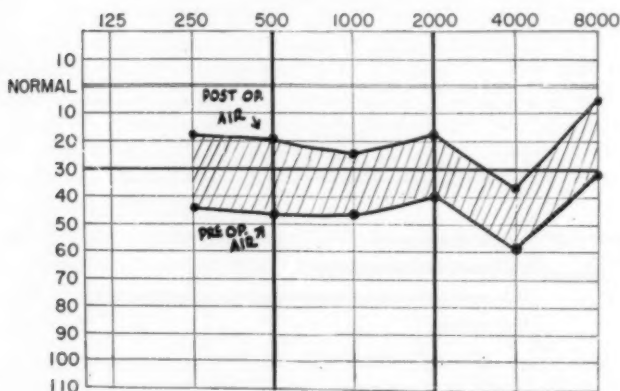
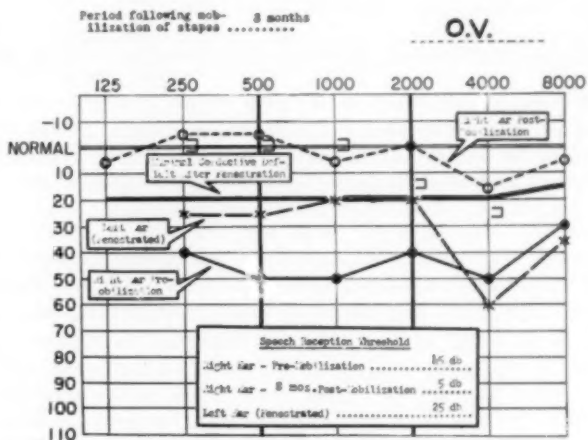


Fig. 9. Mean pre-operative and post-operative pure tone air conduction thresholds are shown for 13 improved A cases.

Nine months ago the opportunity came to compare both ears in the same patient following mobilization in one ear and fenestration in the other. According to McConnell and Carhart,¹⁹ and Davis and Walsh,²⁰ the minimal conductive deficit after fenestration is 20 db, as shown on the comparative audiogram of O. V.

O. V., a 38-year-old seaman, had bilateral progressive deafness for three or four years. In June, 1953, a left fenestration was performed by another surgeon. The post-fenestration hearing in the left ear had reached its maximum (20 db). In April, 1954, the right rigid stapes was mobilized, and within three weeks the right ear had gained maximum improvement (to less than the 5 db level) which has been maintained for the past eight months (see Audiogram, Case 2. O. V.).



Case 2. O. V. This audiogram represents the comparative maximum effects from fenestration and mobilization.

BONE SHIFTS IN A CASES.

The reversal of part of the pre-operative loss by bone conduction following successful fenestration has been widely reported by many observers. Carhart, McConnell and others have presented statistical evidence in support of this observation. Carhart postulated that the "bone shifts" were related to the restoration of proper fluid dynamics in the internal ear after the new fenestra has been made. With this in mind, a study was made of the data on bone conduction thresholds before and after successful mobilization of the fixed stapedial footplate. Table III shows the pre- and post-operative bone thresholds of the 13 improved cases in category A.

TABLE III.

Comparison of average pre-operative and post-operative bone conduction levels in 13 improved A cases.

The minus value indicates increased loss.

	Frequency				
	250	500	1000	2000	4000
Pre-Op. Bone Level (db).....	1.9	0.0	4.3	6.7	19.8
Gain in db	-0.6	-3.1	-1.3	-8.1	-9.2
Post-Op. Bone Level (db).....	2.5	3.1	5.6	14.8	29.0

The order of the shift in A cases seems to be the reverse of that generally reported for fenestration cases. It has been noted that in successful A cases the Rinne which was negative before operation becomes positive after operation.

B Cases: Seventy-nine cases are reported by pure tone and speech audiometry data, and an additional 13 cases by speech audiometry results alone. The pure tone and speech audiometry results are reported separately. Thirty-one patients, or 39.3 per cent, achieved a post-operative pure tone level of 35 db or better. Twenty-five, or 32 per cent, heard better than the 30 db pure tone level post-operatively. Twelve, or 15 per cent, had a post-operative hearing loss of only 20 db or better, and in five patients in this category the hearing returned to between zero and 10 db following successful mobilization of the fixed stapedial footplate.

TABLE IV.

Results of Mobilization of the Fixed Stapedial Footplate in B Category Cases.

Pure Tone Average (500, 1000, 2000 cps)			Spondee Threshold	
Number Reported	79		92	
Average Pre-Op. Losses.....	47.5 db		51.9 db	
Post-Op. Audiometric Level	No. of Cases	Per Cent	No. of Cases	Per Cent
0-10 db	5	6.3%	4	4.4%
11-20 db	7	8.9%	11	12.0%
21-30 db	13	16.5%	16	17.4%
31-35 db	6	7.6%	7	7.6%
Total Improved	31	39.3%	38	41.4%
Unimproved or No Follow-Up....	48	60.7%	54	58.6%

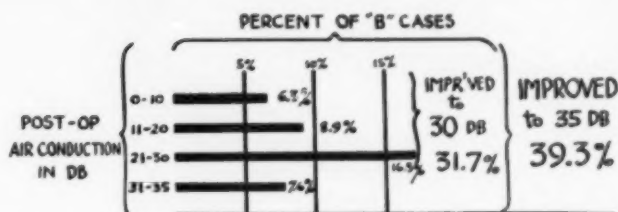


Fig. 10. The graph shows the per cent of 79 B cases showing improvement to the various threshold levels following mobilization of the fixed footplate of the stapes.

In this category the post-operative period ranged from two to 21 months, with an average of 7.4 months between the time of operation and the last post-operative tests.

In those *B* cases which improved following the operation, the average improvement for pure tones in the speech range (500, 1000, 2000) was 25.0 db. The average post-operative level was 22.9 db. Of the 31 improved *B* cases, 12, or more than one out of three, reached a post-operative audiometric level of 20 db or better. The average gain in spondee threshold for the improved *B* group was 25.5 db. The average improvement in each frequency is shown numerically in Table V, and graphically in Fig. 11.

TABLE V.

Comparison of average pre-operative and post-operative pure tone levels in 31 improved *B* cases.

	Frequency					
	250	500	1000	2000	4000	Average (500- 2000)
Pre-Op. Level (db).....	48.6	48.5	49.9	45.3	53.4	47.9
Average Gain (db).....	27.7	25.0	24.8	25.3	24.4	25.0
Post-Op. Level (db).....	20.9	23.5	25.1	20.0	29.0	22.9

***B* CASES AVERAGE AIR LEVELS**
BEFORE AND AFTER MOBILIZATION

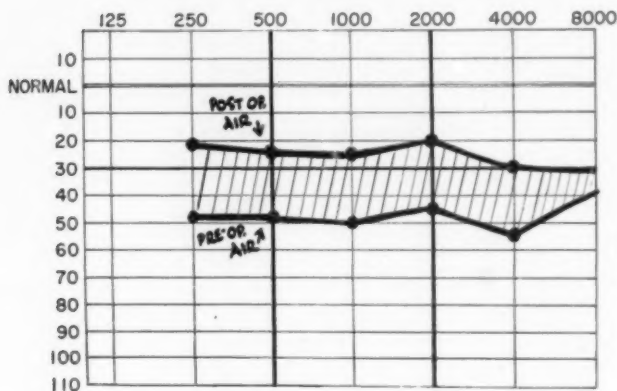


Fig. 11. Mean pre-operative and post-operative pure tone air conduction thresholds are shown for 31 improved B cases.

BONE SHIFTS IN B CASES.

In contrast to the cases in *A* category, there was some gain in hearing by bone post-operatively in the *B* group as shown in Table VI.

TABLE VI.

Comparison of average pre-operative and post-operative bone conduction levels in 31 improved *B* cases.

	Frequency				
	250	500	1000	2000	4000
Pre-Op. Bone Level (db)	6.7	5.6	9.0	17.4	30.8
Gain in db	4.8	6.8	6.5	3.2	4.8
Post-Op. Bone Level (db)	1.9	-1.2	2.5	14.2	26.0

The average of 5.5 db in the region 500 through 2000 cps in *B* cases approximates that reported by McConnell and Carhart for fenestration cases (5.9 db).

C Cases: The percentage of successful results in this category is clearly below that of the *A* and *B* groups.

Forty-nine cases in this category are reported with pure tone and speech audiometry data, and an additional seven are shown with speech audiometry results alone. The pure tone and speech audiometry results are reported separately. Thirteen patients, or 26.6 per cent, achieved a post-operative pure tone level of 35 db or better. Eight patients, or 16.4 per cent reached a level of 30 db or better. Four patients in this category reached a post-operative level of 20 db or better. By speech audiometry, 16 or 29 per cent, reached a post-operative level of 35 db or better, while 12, or 21.4 per cent, reached a level of 30 db or better.

TABLE VII.

Results of Mobilization of the Fixed Stapedial Footplate in C Category Cases.

Pure Tone Average (500, 1000, 2000 cps)			Spondee Threshold	
Number Reported	49		56	
Average Pre-Op. Loss	54.1 db		57.7 db	
Post-Op. Audiometric Level	No. of Cases	Per Cent	No. of Cases	Per Cent
0-10 db	0	0	1	1.8%
11-20 db	4	8.2%	4	7.1%
21-30 db	4	8.2%	7	12.5%
31-35 db	5	10.2%	4	7.1%
Total Improved	13	26.6%	16	28.5%
Unimproved or No Follow-Up	36	73.4%	40	71.5%

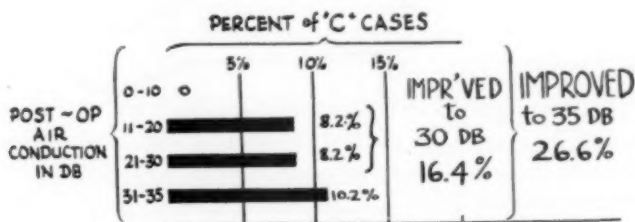


Fig. 12. The graph shows the per cent of 49 C cases showing improvement to the various pure tone threshold levels following mobilization of the fixed footplate of the stapes.

In this category the post-operative periods ranged from one to 14 months with an average of 5.3 months between the time of operation and the last post-operative tests.

In those cases in which the hearing was improved following mobilization, the average improvement for pure tones was 26.9 db. The average post-operative level was 27.2 db. The average gain in spondee threshold for the improved C group was 25.7 db.

TABLE VIII.

Comparison of average pre-operative and post-operative pure tone levels in 13 improved C cases.

	Frequency						Average (500- 2000)
	250	500	1000	2000	4000	8000	
Pre-Op. Level (db)	48.9	53.6	54.7	54.1	65.7	54.6	54.1
Average Gain (d)	25.8	26.9	29.2	24.6	22.3	6.7	26.9
Post-Op. Level (db)	23.1	26.7	25.5	29.5	43.4	47.9	27.2

***C* CASES AIR LEVEL AVERAGES
BEFORE AND AFTER MOBILIZATION**

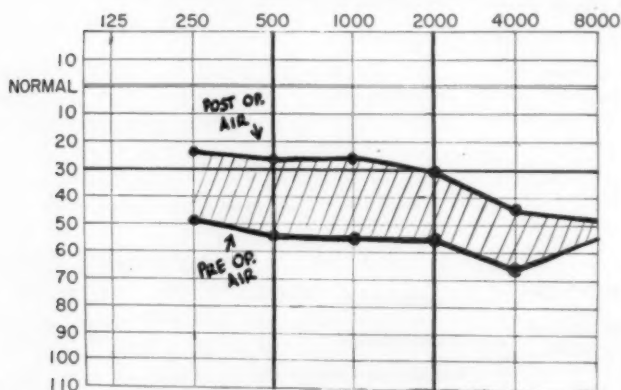


Fig. 13. Mean pre-operative pure tone air conduction thresholds are shown for 13 improved C cases. The gradual slope toward the high tones post-operatively is related to the poorer bone levels used in selecting cases for this category.

BONE SHIFTS IN *C* CASES.

The post-operative bone conduction gains in the *C* category are considerably greater than in the *B* category, as shown in Table IX.

TABLE IX.

Comparison of average pre-operative and post-operative bone conduction levels in 13 improved *C* cases.

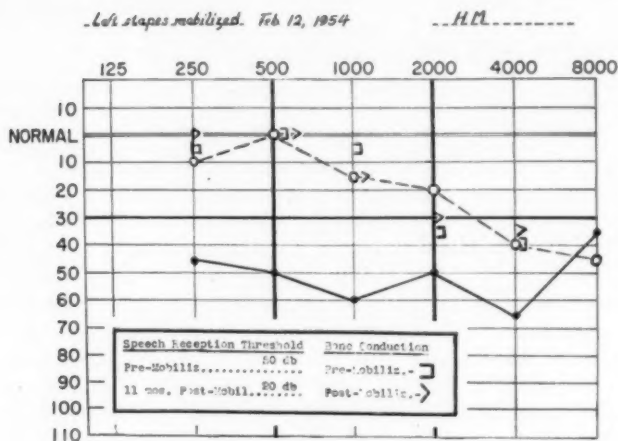
	250	500	Frequency 1000	2000	4000
Pre-Op. Bone Level (db)	8.1	9.0	15.1	27.5	41.3
Gain in db	7.3	12.1	13.3	5.4	7.3
Post-Op. Bone Level (db)	0.8	-3.1	1.8	22.1	34.0

It is apparent from the results shown that *A* and *B* cases (maximum bone conduction loss of 20 db at 500, 1000 and 2000 cps), are most suitable for mobilization. Forty-two per cent of the combined *A* and *B* patients reached a post-operative level of 35 db or better by pure tones (46 per cent by speech audiometry) while 36 per cent reached 30 db or better by pure tones (37 per cent by speech audiometry). If the results of the *C* Cases (maximum pre-operative bone conduction loss of 30 db at 500, 1000 and 2000 cps) which are generally less suitable, are added to the combined *A* and *B* Case results, 37 per cent reached a post-operative level of 35 db or better by pure tones (40 per cent by speech audiometry), while 30 per cent reached a level of 30 db or better by pure tones, and 32 per cent by speech audiometry.

D Cases: This category includes all patients whose pre-operative bone conduction loss was greater than 30 db at one, two or three of the speech frequencies (500, 1000, 2000 cps). Of the 211 cases in this series, 38 patients who were operated upon belong in this category. In 34 of the 38 patients, the hearing loss by bone conduction was greater than 30 db at 2000 cycles only, whereas at 500 and 1000 cycles the hearing by bone was better than 30 db. The pre-operative pure tone air losses in the speech frequencies for the *D* cases ranged from 43 db to 90 db. Ten achieved a gain in hearing ranging from 15 db to 40 db. Four in this group reached hearing levels of 35 db or better. Of the four, one reached the 15 db level, and one the 20 db level (see H.M. audiogram). On this case, al-

though the hearing by bone conduction was poor at 2000 and 4000 cps, it was excellent at 500 and 1000 cps. This apparently explains the favorable result.

Some of the patients in this category were operated upon with the purpose of improving the hearing sufficiently to increase the benefits to be derived from a hearing aid and other



Case 3. H. M. The solid lines indicate the air conduction audiogram taken just before mobilization of the fixed footplate of the stapes. The dashed line shows the post-operative threshold. In this case the air-bone gap appears to have been closed by the operation.

rehabilitation measures. This is particularly true in those cases of otosclerosis with considerable cochlear involvement. The ten Class D patients who achieved post-operative gains in hearing of 15 db or more are in this group.

AIR-BONE GAPS.

The essential feature of this operation is the preservation of nature's sound conducting mechanism; therefore, when the ankylosed stapes is mobilized the normal physiology of hearing is re-established. It is not surprising, therefore, that 50 per cent of the patients who reached the 30 db level or better, are able to hear within 15 db of their cochlear potential, as measured by bone conduction.

TABLE X.
Residual Air-Bone Differences in Improved Cases.

Post-Op. Air-Bone Gap	No. of Cases	Per Cent of Improved Cases
0-5 db	8	21.0
6-10 db	7	18.4
11-15 db	4	10.5
16-20 db	3	7.9
over 20 db	16	42.1
Total	38	100.0%
Bone conduction data unavailable.....		13 cases

POST-OP AIR-BONE GAPS IN CASES IMPROVED TO 30 DB OR BETTER.

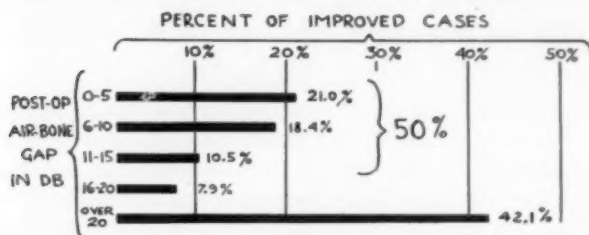


Fig. 14. Residual air-bone gaps following successful mobilization in A, B and C cases.

Will the Hearing Restored by this Technique Last?

Table XI shows the duration of improved hearing for all cases which reached a post-operative level of 35 db or better.

TABLE XI.
Duration of Improved Hearing From Mobilization to Most Recent Test.

Duration Up to Most Recent Test	No. of Improved Patients	Total No. Operated
Under 3 months	12	46
3-6 months	24	77
6 months-1 year	14	68
1-2 years	9	13
Over 2 years	2	2
Total	61	206
No follow-up		5
Improved then regressed to pre-op. level.....		2

Two additional patients who showed improvement by hearing tests following the operation subsequently returned to the pre-operative level within two months. One other patient's hearing regressed from a post-operative level of 15 db to 30 db 17 months after operation.

These results indicate that in all but three cases showing audiometric gain up to the 35 db level or better, the hearing improvement has been mainted for periods up to and exceeding two and one-half years.

Is the Hearing Made Worse by Mobilization?

In none of the unimproved cases did the hearing fall more than 10 db below the pre-operative level by pure tone and speech audiometry.

What are the Indications for This New Procedure?

At present it can be stated that all patients with progressive conductive deafness in whom the history, physical and audiological examinations indicate a fixed stapedial footplate due to otosclerosis are suitable for mobilization. Also mobilization is indicated in the early cases of otosclerosis in which the hearing loss is less than 30 db. The hearing loss in such patients is not great enough to derive the benefits of fenestration or the hearing aid. In addition, mobilization seems indicated in cases of profound hearing loss due to long-standing otosclerosis. In these cases the goal of mobilization is one of rehabilitation of the patient with or without a hearing aid.

What are the Significant Features of This Technique?

This is a minor operation and a short one. The surgical shock is almost nil. Following the operation the patient may have his regular meals, is ambulatory, leaves the hospital the following morning, and may go back to work in a few days. Surgical after-care consists only in removing the dressing covering the ear on the fourth or fifth post-operative day. In about two weeks after the operation the skin of the canal is healed and the drum, which has been red and swollen, begins to take on its normal appearance. There is no post-

operative vertigo or any disequilibrium. In many cases the tinnitus disappears the instant the footplate is mobilized. Patients are allowed to swim, dive, travel by air, etc., without restriction.

Are There Complications?

In five cases suppuration of the middle ear occurred shortly after the operation and resolved. Three of these followed an upper respiratory infection. The hearing in four of the five cases did not improve. In one the hearing ultimately reached the 20 db level, which has been maintained for 14 months to date. A perforation of the drum has persisted in one patient.

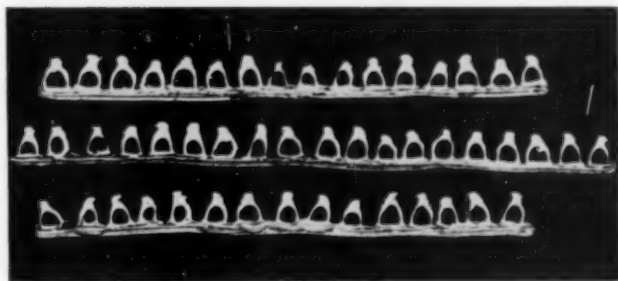


Fig. 15. Fifty stapes removed from fresh cadavers with the footplate completely fixed in cement. Despite the wide variation in structure and thickness of the crura, firm pressure on the head and neck produced no motion whatever. Note the differences in the thickness of the crura. Relatively few have very thin crura.

Of the 211 cases, none showed any evidence of labyrinthitis, facial palsy, erysipelas or perichondritis. In a small number the drum was perforated during the operation but healed within ten days.

Upper respiratory infection shortly after operation depresses the hearing markedly and should be avoided.

What Surgical and Technical Factors Contribute to Success or Failure?

The most important element in the success or failure of the operation is the degree of fixation of the stapedial footplate and the thickness of the crura (see Fig. 15). Success of

the operation occurs when pressure on the neck of the stapes fractures the otosclerotic bone responsible for the ankylosis, thus allowing the footplate to move freely. Failure to improve the hearing occurs when the otosclerotic bony mass causes such a great degree of stapedia fixation that the crura fractures, leaving the immovable footplate. The mobilizer must exert its pressure only on the neck of the stapes, which is thick and strong. Even very light pressure of the mobilizer just below the neck will cause a crural fracture at once, in which case a fixed footplate, which might have been mobilized, is left behind.

The muscles involved in the actual pull of the mobilizer against the neck of the stapes are the small muscles of the fingers and hand; never the larger muscles of the elbow or shoulder.

Some of the pitfalls in this operation should be mentioned. In the beginning, because of the bulge of the bony canal wall, it is difficult to separate the skin and lift the drum out of its sulcus anteriorly without tearing either the skin or the drum. In some cases the incus and stapes are completely hidden by the posterior bony canal wall. The edge of the bony canal wall must, therefore, be removed cautiously to expose the ossicles. Care must be taken not to separate the incudo-stapedial joint during the mobilization. Care must also be exercised not to dislocate the footplate of the stapes by too sudden and too great pressure against the neck. Again, it is well to discover these pitfalls on the cadaver.

What Other Factors Contribute to Success or Failure?

In addition to the surgical aspects, other evidence was studied to determine why some patients benefit from this procedure while others do not.

1. *Pre-operative Hearing Tests:* There did not appear to be significant differences between the improved and unim-

proved groups within each of the *A*, *B* and *C* categories in the following respects: *a.* Pre-operative average air conduction thresholds (500-2000 cps); *b.* Average bone conduction thresholds (500-2000 cps); *c.* Bone Threshold at 2000 cps; *d.* air-bone gaps (average of 500-2000 cps as well as at 2000 cps alone); *e.* Speech reception thresholds, and *f.* Discrimination scores.

2. Age at Time of Operation: There does not appear to be significant differences between the improved and unimproved groups within each category with regard to age. The average age of patients in the *C* and *D* categories, who by definition showed more cochlear involvement was greater than those in Class *A* and Class *B*. Within each category, therefore, the age of the patient is apparently unrelated to success or failure of the operation.

3. Duration of Deafness Prior to Surgery: In this series there appears to be significant differences between the improved and unimproved groups, particularly in the *A* and *C* categories, in the length of time deafness was reported by the patient to have existed prior to the operation. The history of deafness was of longer duration in the unimproved group in each category. In the unimproved group there is usually greater fixation of the footplate of the stapes, which is more difficult to mobilize; however, there are notable exceptions. Sometimes in patients with a shorter history of deafness the rigidity of the footplate does not permit its mobilization, and at other times in patients with a long history of deafness the footplate can be mobilized, as shown by the ranges in Tables XII.

TABLE XII.
Duration of Deafness Prior to Operation (In Years).

Category	A		B		C		D		All Cases
	Av.	Rge.	Av.	Rge.	Av.	Rge.	Av.	Rge.	Av. Rge.
Improved Cases	8.8	1-25	11.4	2-28	10.0	1-20	15.0	3-26	11.1 1-26
Unimproved Cases	13.1	2-28	12.6	1-32	17.4	3-45	16.4	3-31	14.7 1-45

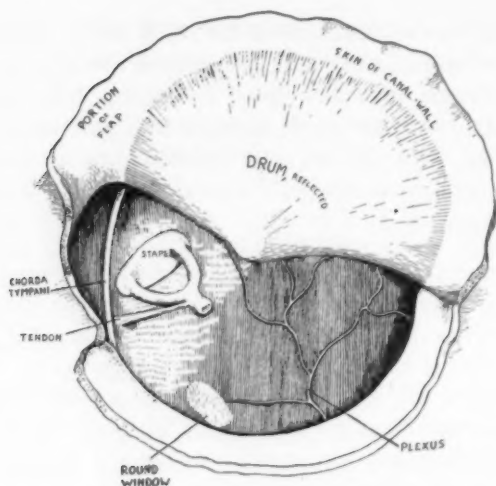
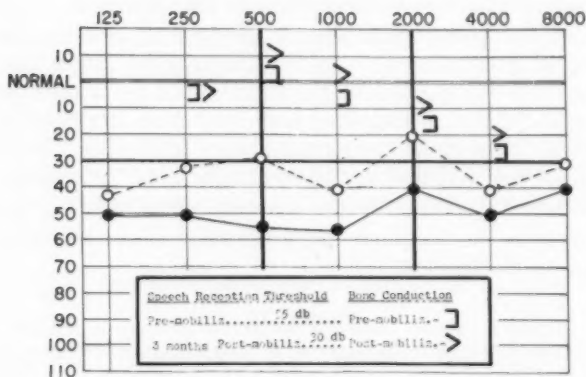


Fig. 16. Drum, skin of canal wall and portion of skin flap made at fenestration are lifted upward. The stapes can be seen in its entirety. Stapes is then mobilized as in non-fenestrated cases.

LEFT EAR FENESTRATED 1944
STAPES MOBILIZED AUG 23, 54

H.C.



Case 4. H. C. Left Ear. The solid line indicates air conduction audiogram taken just before mobilization of the stapes. This ear has been fenestrated unsuccessfully in 1944. The dashed line shows the air conduction audiogram for the same ear three months after mobilization of the stapes. The speech reception thresholds and pre-and post-mobilization bone conduction thresholds are also shown.

Can Improved Hearing Result from the Fenestration Operation on the Side in Which the Rigid Footplate Could Not be Mobilized?

In a presentation to the Audiological Congress in Paris, in January, 1955,²¹ Dr. Werth of Israel, trained by Cawthorne of London, reported that in the past two years he has had success in 14 out of 16 fenestration operations performed on ears after unsuccessful mobilization. His results in these cases showed that of the 14 successful fenestrations, seven are better and seven worse than the Shambaugh²² prediction; the average improvement was 28 db as against 26 db predicted. These fenestration results are similar to those obtained in virgin ears. Werth found no special difficulties in performing fenestration in these cases. A few others have reported to the author successful fenestration results after unsuccessful mobilization.

Can Improved Hearing Result from the Mobilization of the Fixed Stapedial Footplate on the Side in Which the Fenestration Operation has Failed?

The following case, H.C., is of special interest because hearing was restored by mobilizing the fixed footplate of the stapes in the ear which was unsuccessfully fenestrated:

This 50-year-old housewife had a left fenestration operation performed ten years ago. Since the fenestration, the hearing in this ear had fallen to 50 db in the speech frequencies. The operative cavity was healed. The fenestra was closed osteogenetically, since repeated mechanical irritation all around the fenestral site failed to evoke any vestibular reaction. In August, 1954, the mobilization technique was used in elevating the drum and skin. About 6 to 8 millimeters of the lower portion of the skin flap made at the fenestration was also elevated along with the above. The incus of course had been removed at the time of the fenestration operation. The stapes was thus exposed in its entirety (see Fig. 16). It was found rigid on palpation and was mobilized. The hearing improved and has been maintained. (See Audiogram, Case 4.)

DISCUSSION.

No discussion of a new surgical procedure for otosclerotic deafness should fail to mention the great contributions of Holmgren, Sourdille, and particularly Lempert, in the development of the very effective fenestration operation. The present work is a natural consequence in the quest for a simpler procedure. We are all indebted to Dr. Lempert for his pioneer work in the surgery of otosclerosis. The interest which he

stimulated in our field has been a challenge to all of us to search always for additional techniques of treating deafness. Were it not for his contribution to otology this technique of mobilization might not have been developed.

Stapes mobilization, stapedectomy and other operations in the middle ear to improve hearing date back to the latter part of the last century. The operations were performed mostly through a myringotomy opening, or after removal of all or part of the drum; however, all of these operations were abandoned 50 years ago.

In the present technique, instead of myringotomy, the lower half of the intact drum is lifted out of its sulcus and folded upward upon itself, as Lempert did in his tympano-sympathectomy operation. This gives a wider exposure of the middle ear than myringotomy but does not expose the stapes sufficiently; therefore, enough of the edge of the posterior bony canal wall is removed to bring the important structures into clear view, without which precise mobilization of the stapes cannot be safely performed. This, together with the specially devised instruments, represents a new technique of stapes mobilization.

Since the ossicular chain is preserved in the mobilization operation it is possible to restore hearing to the limits of the cochlear potential. No other treatment can do this today.

The patient with early otosclerosis whose deafness is not yet severe enough for fenestration seems to have an opportunity for achieving normal hearing by mobilization.

It is surprising from the histo-pathological point of view that the fractured otosclerotic bone does not begin to heal at once and ankylose the stapes footplate again. All but three of the successfully mobilized cases have maintained their hearing improvement, indicating that the footplate is still mobile. The otosclerotic focus may contain the kind of bone which when fractured does not heal, as fractures through the labyrinthine capsule frequently do not heal.

It is not intended to make any comparison between fenestration and the author's experience with the mobilization operation. This report introduces a new technique of stapes

mobilization as an *additional* surgical tool for otosclerotic deafness.

It has been shown that fenestration can restore hearing in an unsuccessfully mobilized ear, and mobilization can restore hearing in an ear unsuccessfully fenestrated. It is indeed fortunate that the two procedures can complement one another. It is realized, moreover, that it must be satisfactorily demonstrated in a large series of cases that a sufficient number of patients in whom mobilization failed can be successfully fenestrated. If the number of successful mobilizations, plus the number of successful fenestrations in mobilization failures, approaches or exceeds the percentage of success of fenestration alone, then patients with otosclerosis can be offered the mobilization operation first. The next step in this work is the study to determine the success with which mobilization failures can be successfully fenestrated.

It is hoped that interest in mobilization of the stapes will lead to further refinements and additions in technique with even greater benefits to those afflicted with deafness.

SUMMARY AND CONCLUSIONS.

1. A new technique is described for the restoration of hearing by mobilizing the fixed footplate of the stapes in otosclerosis.
2. One of the major features of this operation, which permits the physiological restoration of a normal conducting mechanism, is that it can improve hearing to the limit of the cochlear potential as measured by bone conduction.
3. Results in 211 cases operated between April, 1952, and August, 1954, are statistically analyzed.
4. In Class A cases (maximum pre-operative loss of 10 db by bone conduction in the speech frequencies) 52 per cent achieved pure tone levels of hearing between normal and 35 db and 64 per cent reached these levels by speech audiometry. In Class A cases 48 per cent reached the 30 db level or better by both pure tones and speech audiometry. In this group two patients achieved hearing within normal limits in the speech range.
5. In Class B cases (maximum pre-operative loss of 20 db by bone conduction in the speech frequencies) 39.3 per cent

achieved pure tone levels of hearing between normal and 35 db and 41.4 per cent reached these levels by speech audiometry. In Class *B* cases 32 per cent reached the 30 db level or better by pure tones while 34 per cent reached this level by speech audiometry. In this group five patients achieved hearing within normal limits in the speech range.

6. In Class *C* cases (maximum pre-operative loss of 30 db by bone conduction in the speech frequencies) 26.6 per cent achieved pure tone levels of hearing between normal and 35 db and 28.5 per cent reached these levels by speech audiometry. In this category 16 per cent reached the 30 db level or better by pure tones while 21 per cent reached this level by speech audiometry.

7. When the percentages of improved patients in the categories most suitable for mobilization (*A* and *B*) are combined in accordance with the number in each category, 42 per cent reached pure tone levels between normal and 35 db (46 per cent by speech audiometry), while 36 per cent achieved a hearing level between normal and 30 db. If the percentages of improved patients in the *C* category (generally less suitable) are added to those of *A* and *B*, 37 per cent reached levels of 35 db or better by pure tones and 40 per cent by speech, while 30 per cent reached a level of 30 db or better by pure tones and 32 per cent by speech audiometry.

8. A total of seven patients obtained a post-operative hearing level within normal limits (less than 10 db loss).

9. In none of the unsuccessful cases did the hearing fall significantly below the pre-operative level.

10. Patients with early otosclerosis with a hearing loss of 30 db or less may be ideal for mobilization, since the hearing loss is not great enough for fenestration.

11. Successful mobilization may contribute to the auditory rehabilitation of a patient with severe otosclerotic deafness when the conductive element is reduced or eliminated.

12. A case is presented showing that mobilization of the fixed stapedial footplate restored hearing in an ear previously fenestrated without success.

13. A patient with otosclerotic deafness now has two

opportunities for surgical restoration of hearing: 1, mobilization of the fixed footplate and 2, fenestration.

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101 East Seventy-Third Street

DISCUSSION.

JOSEPH L. GOLDMAN, M.D. (New York, N. Y.): Realizing our responsibility in this work, it was decided last September to conduct an independent study on private as well as service cases admitted to the Mount Sinai Hospital for the mobilization operation. Since then 55 private patients, all belonging to Dr. Rosen, and five service patients, were admitted to the hospital. Two audiograms were made preoperatively on each patient by an audiologic technician, and two follow-up audiograms were made about two months or more after the operation.

It was not intended to report this investigation until the complete data had been gathered; however, I am making this premature and preliminary report so that all available information from our hospital records can be presented to you.

So far there have been 22 follow-up examinations on the private patients and five follow-up examinations on the service cases, making a total of 27.

Of the 27 patients who have been seen post-operatively, nine, or 33 per cent, reached the 30 db level in the three critical speech frequencies and 13, or 48 per cent, reached the 35 db level.

The tympanic membrane was found intact in every case, slightly retracted in six, and markedly retracted in one case.

In my estimation there appear to be two main issues in relation to this work: first, there is the question of whether the results obtained from the mobilization operation will last. Obviously time alone can answer this question; second, there is need to determine if mobilization failures can be fenestrated successfully in a large series of cases. If this phase of the problem can be carried out successfully, and if results from mobilization of the stapes persist, then I believe that the mobilization operation will deserve to be considered as an additional surgical method in the treatment of otosclerosis.

RICHARD J. BELLUCI, M.D. (New York, N. Y.): My experience with the operation for mobilization of the stapes extends over a period of almost one year, as the first case was performed at the Manhattan Eye, Ear and Throat Hospital on April 15, 1954. The cases selected were satisfactory material for the fenestration operation and satisfied the following criteria:

1. All cases had more than 35 db loss by air conduction.
2. Most cases had very good bone conduction, a few had a drop in the higher frequencies but would be considered good cases for the fenestration operation.

3. All had negative Rinne for 512 and 1024.

4. All had positive paracusis.

As a preliminary study attention was directed toward:

1. Determining whether the stapes, once mobilized, would allow improvement in hearing to the serviceable level.

2. How often could an improvement in hearing be expected in a given group of cases on which the mobilization operation was attempted.

3. How long would the improvement in hearing last.

Analysis of results found cases falling into four groups:

1. Unquestionably better hearing from the standpoint of the patient and confirmed by audiometric studies — 28 per cent.

2. Questionable improvement in hearing. Patient heard slightly better the first day or in the operating room, but either did not maintain this improvement or the improvement could not be confirmed by audiometric studies — 22 per cent.

3. Improvement which was satisfactory immediately postoperative and followed by regression to the preoperative level of hearing — 6 per cent.

4. Mobilized but no improvement — 4 per cent.

It is difficult to make any definite conclusion from this small group of cases which have been observed for such a short period of time; however, we may develop a general impression from this work and thus direct a particular line of thinking. We can make the following statements at this time from this work:

1. We found that the stapes can be mobilized in about 60 per cent of the cases.

2. Under ideal conditions a satisfactory improvement of hearing above 30 db can be expected in one of four patients attempted.

3. A rather large group of patients, although ideal candidates, who apparently had a successful mobilization of the stapes did not obtain the improvement expected. Further study is required to determine the cause of failure.

4. In this series three patients lost the initial improvement in hearing in 4 to 6 weeks. The others who experienced the improvement, having survived the initial 4 to 6 weeks, did not seem to deteriorate in the subsequent period of observation. These patients, however, must withstand the test of time before we can call them rehabilitated.

Stapes Fractured.....	18—39 per cent
Stapes Mobilized.....	28—61 per cent
Hearing Improved.....	28 per cent
Over three months.....	10
Under three months.....	3
Improvement Lost.....	6 per cent
In one month.....	3
After one month.....	0
Unsatisfactory Improvement.....	10—22 per cent
No Improvement.....	2—4 per cent
Total Number of Cases.....	46

JULIUS LEMPert, M.D. (New York, N. Y.): There was never any question in my mind that if you succeed in mobilizing the ankylosed stapediostapedial joint in an ear deafened as a result of otosclerosis, in the presence of an adequate cochlear nerve function reservoir, without dislocating the incudo-malleolar joint and without fracturing one or both stapedia crura, the hearing in that ear will be improved for a while if the tympanic membrane remains intact. This has been amply demonstrated by Miot of France, who reported 200 cases of mobilization of the stapes in 1890, and by Jack, of Boston, who in 1894 practiced both mobilization first when possible and resorted to stapedectomy when mobilization was not possible. They stated that mobilization of the stapes is as a rule not accomplishable in stapedia ankylosis secondary to otosclerosis, without disruption of the ossicular chain; however, if mobilization of the stapes for the improvement of hearing in otosclerosis is to be revived again, I believe that for the good of humanity and otology, the following two questions must be answered:

1. What new contribution has been made or even been suggested since the universal condemnation and abandonment of stapedia mobilization to advance the prospect of preventing reankylosis of the stapediostapedial joint and thus justifying the revival of this surgical procedure?

The otosclerotic lesion which is responsible for the ankylosis of the stapediostapedial joint is a highly vascularized osteo-fibrotic growth which when injured regenerates rapidly. During the performance of the fenestration, whenever the otosclerotic lesion was found to have involved also the bony capsule of the external semicircular canal, early post-operative closure of the newly created fenestra followed as a rule. Upon revision of such a fenestra a wildly growing excrescence of osteo-fibrotic bone can always be seen; furthermore, even if there was a surgico-mechanical means devised of preventing reankylosis of the stapediostapedial joint, the ossicular chain would have to be disrupted to render the oval window region accessible to such treatment, thus once again defeating the very purpose for mobilizing the stapes.

2. How often can a stapediostapedial joint ankylosed as a result of otosclerosis be mobilized without disrupting the ossicular chain by severing the incudo-stapedial joint or fracturing one or both stapedia crura?

In order to investigate this problem without jeopardizing the chances for improving immediately the hearing of my patients, I devised a new one-stage double-feature fenestration technique. This technique which I now exclusively employ permits the mobilization of the ankylosed stapediostapedial joint whenever possible without disruption of the ossicular chain under direct unobstructed vision and without opening the mastoid process. It also permits the immediate follow-up with the performance of the fenestration operation with the subcortical approach through the posterior bony wall of the external auditory canal when the stapediostapedial joint was found to be immobilizable, or when the

incudo-stapedial joint was severed, or when the stapedial crura were fractured.

I have attempted to mobilize the ankylosed stapedio-vestibular joint with this one-stage, double-feature technique in 50 cases of clinical otosclerosis, and succeeded in accomplishing this without dislocating the incudo-stapedial joint and without fracturing the stapedial crura in only seven otosclerotic ears.

Even though I should have succeeded in mobilizing the stapedio-vestibular joint successfully in 25 of the 50 cases, my moral obligation to do my best to improve my patients' hearing would not have permitted me, in the present status of the successfully time-proven fenestration operation, to gamble with the use of the long since discredited, basically doubtful, stapedial mobilization operation for obtaining, and continuously thereafter maintaining, the much desired improvement of hearing. I, therefore, without any apprehension or regret fenestrated the 50 ears.

Everyone interested in otologic surgery, including the most skillful and most experienced fenestrators, would gladly welcome a simpler technique for improving hearing in clinical otosclerosis, providing the end results of such a technique could approximate the results obtainable today with the fenestration operation.

Should a basically sound means for preventing reankylosis of the stapedio-vestibular joint ever be found, my new one-stage technique could serve well for improving the hearing with either mobilization or fenestration, in one session. To turn the clock backward of 50 years' progress in otology with the use of the discredited mobilization technique is a great injustice to deafened humanity and modern otology.

GEORGE E. SHAMBAUGH, JR., M.D. (Chicago, Ill.): I should like to bring out just a few points relative to this most interesting presentation of Dr. Rosen.

I have had the opportunity to test three of those patients whom Dr. Rosen has operated upon. Two I tested in his office, on his audiometer; patients operated upon more than a year ago, and I can attest to the fact that they had excellent hearing results. One patient had come to me several years ago. She was an ideal case for fenestration with essentially normal bone conduction. She had the Rosen procedure done by Dr. Rosen, and she returned to see me three months afterwards. She had no hearing improvement, although she herself told me that she was hearing better, and that she heard better on the table.

There are several questions which must be answered. These have been brought out before, but I think they bear repeating: the first is the durability of the procedure. Of course, time only will answer this question.

The second is, what is the batting average of this procedure as compared to fenestration?

May I have the first slide? (Slide) Recently we made a study of the hearing results in ideal cases; A-cases tested two years or more after operation. We were interested in correlating, if possible, the difference in results with the different size of fenestra, and we took 100 consecutive cases. On the right hand side you see the results in these A-Cases: 84 per cent in their two-year test were brought above the practical level; 15 per cent were improved not quite to the practical level, between 30 and 35 db, and 1 per cent had improvement of no more than 10 db, so that there was one failure in this series with no improvement and 84 per cent had a restoration of practical hearing. This compares with Dr. Rosen's report of 48 per cent of his A-cases restored to the practical level and

52 per cent with an improvement to the 35 db level or better. It is our opinion that a patient who is ideally suited for fenestration deserves to have the fenestration operation performed rather than this relatively uncertain procedure.

Dr. Rosen brings up the point that the patient can have a fenestration if his procedure is unsuccessful, and that the mobilization maneuver will not produce a further improvement in hearing.

We have done only 14 of these operations, following Dr. Rosen's technique as closely as possible. This was a patient (slide) who was not suitable for fenestration. On the left hand audiogram you see the air conduction curve, the solid line and the bone conduction curve. Because the patient was not suitable for fenestration the mobilization procedure was suggested, and the patient accepted. On the right hand side you see the result one week after operation: a very definite further loss in hearing due to serous labyrinthitis. Whether this will recover or not we do not know, but it is possible to get temporary, at least, labyrinthine damage from this procedure.

This was the patient (slide) ideally suited for fenestration. Notice the very excellent air bone gap. On the left side you see the air curve, between 50 and 60 db loss, and the bone curve within the normal limit; a case of complete stapes fixation. The usual fenestration operation was performed without incident, and no bleeding into the fenestra. The Rosen maneuver was then carried out on the stapes. The stapes suddenly became mobile, a moment later profuse bleeding began to issue from deep within the labyrinth. It was coming from the region of the stapes footplate. I am sure that I inadvertently luxated the stapes footplate in the labyrinth. Notice this patient's hearing test two weeks after fenestration and mobilization, a further loss undoubtedly due to the labyrinthine damage. I do not think that this procedure is a completely harmless procedure. I believe there will be cases of labyrinthine damage, and that this must be taken into account in advising the procedure for patients.

Again we must stress the psychology of the patient who has had an unsuccessful mobilization. Many of these patients were highly suited for fenestration and will refuse to submit to a second procedure. They tried surgery and failed. They are through, and they will be deprived of the possibility of restoration of practical hearing from this fact. We have done 14 of these operations to date, a very small series. I am sure that our technique is far from perfect, although I had the opportunity of having learned this technique from Dr. Rosen. We have only four results that were good, which I consider a very disappointing batting average, and these are our initial results. It is now five and one-half months wherein the hearing improvement was as good or perhaps a little better than the results of fenestration would have been.

Finally, the technique of this procedure is not easy; do not be deluded. To me it is as difficult, possibly more difficult, because I have done fewer of these cases than fenestrations.

VICTOR GOODHILL, M.D. (Los Angeles, Calif.): The discussion of this paper both pro and con resembles very closely some of the discussions reported in the *Boston Medical and Surgical Journal* in the early 1890s, and they make very fascinating reading.

This stapes approach to stapedia-vestibular ankylosis is not in its infancy but rather in its second childhood. My interest is dual:

A. What is the pathologic physiology of lysis or liberation of stapedia

vestibular fixation? Perhaps the word "ankylosis" is not the very best term to use here.

B. If such fixation can be surgically relieved, what long term changes might be expected?

I am prepared to discuss only "A" because my experience with "B" is too short to warrant any opinion as to the future of this operation, as far as the patient is concerned; therefore in showing my cases, if I may, I should like to stress the fact that I am reporting only the immediate post-operative results. In working with this problem, my technique has varied in some respects from the techniques described by Jack, Miot, Sieberman and Rosen. I should like to emphasize what Dr. Shambaugh said. The technique is not easy.

I would like to emphasize the difference in my technique. First of all, the incision is a larger one and collar-shaped.

Second, I find that frequently I have to employ a burr to expose sufficient bone to be able to observe the incudo-stapedial joint adequately.

Third, in most cases I have found the use of the microscope of great value in that it has revealed to me that many so-called mobilizations, so-called fractures of the crura, were not done by the surgeon, although I did plenty, but were present as the result of disease. It is possible to see that the footplate has long ago disappeared and been replaced by osteogenetic bone in the fenestra ovalis.

Fourth, and perhaps most important, I have found that in many instances I could not tell whether or not I could mobilize the stapes by the responses of the patient to my whispered voice. I found that frequently I was too enthusiastic, spoke loudly to the patient, and was quite happy when he heard me. I found it possible to employ operative audiometry, which is possible on the table, and which has given me a very valuable help in detecting when apparently slight displacement will produce improvement in hearing.

Fifth, the displacement of the fixed footplate I found to be very difficult to perform by motion applied to the stapedial neck itself. In many cases I found it was very easy to dislocate the incudo-stapedial plate by this technique. Consequently I found I could avoid such dislocations more frequently by applying force through the incus itself in the direction of the incudo-stapedial joint.

Sixth, I found that I could not tell by digital palpation techniques what I was accomplishing. I frequently was too ambitious in digital pressure, and so I have been using a controlled pressure by a micro-vibrator attached to the dental engine, particularly in cases of marked fixation.

Seven, I have tried to preserve the chorda tendinea wherever possible.

Eight, I have occasionally sacrificed the stapedial tendon in order to obtain mobility.

This (slide) will show the technique of operative audiometry where we do a reading after the drum has been opened and then replaced, so that the drum is closed. We test the hearing by pure tones on the operating table with a sterile sheet interposed between the ear phone and the ear, and we test it by responses of the threshold to four frequencies, 500 through 4,000. We then test when the drum is open and the middle ear is exposed and then when we have applied some force to the incudo-stapedial joint. If the test at that point shows a significant improvement

in hearing we close the middle ear, and then test the hearing for the fourth time. We will just show the one on operative audiometry. As you will notice in this illustration with the middle ear closed — 55, 70, 50 and 60, with the middle ear open drop — 75, 65, 55. Very strangely, as noted in many instances, there was an improvement at 4,000 cycles without doing anything to the incudo. With the stapes mobilized a definite improvement, when compared with the middle ear — 60, 50, 45 and 35, and with the middle ear closed — 35, 35, 35, 20, which is in marked contrast to the middle ear closed; at first, and in this patient post-operatively, you will notice a change in air threshold, as computed by the Fletcher formula of 25, in contrast to 45, to 500, 30 and 45; 25 to 40 and 50; and 30.

Slide No. 4 will show immediate results in the so-called good candidates, in which I have classified the candidates as having bone conduction levels of 20 db. Here I will not belabor all these cases, but I would like to show that there is a significant number that are worse. It is true that most of them are not worse by any great degree. Some of them, however, are worse by as many as 15 db in the speech frequencies. In this group there were 41 per cent that had improvement up to or better than the satisfactory level commonly accepted in fenestration surgery, between 25 and 30 db in the speech frequencies. Six per cent had only a partial gain, not significant; 18 per cent were unchanged, and 33 per cent were definitely worse.

This group is the experimental group (slide) of poor candidates, who would never be acceptable for fenestration surgery, and in my opinion are not patients for mobilization. These had bone conduction of less than 40. None of them reached the practical level although they did obtain improvement.

This last slide is the most interesting of the group, in that these are the so-called poor candidates with bone conduction between 20 and 40 db. In this group we have the largest number of elevations of threshold to practical level — 60 per cent reached it, 14 per cent were partially improved, 14 per cent improved, and seven worse. I should like to emphasize that these are primary results and not at all follow-up studies. I conclude my feeling about this procedure by saying that this is an interesting and essential approach to the study of the surgical physiology of otosclerosis, stapedia vestibular fixation. Its future as a rehabilitation measure must be determined by further study.

CLAIR M. Kos, M.D. (Iowa City, Iowa): My experience has been limited to 63 cases of stapes mobilization and those that achieved what we call practicable or serviceable results were 18, or about 28 per cent.

I am a little surprised at the emphasis that is being placed upon the suitability of these patients for mobilization as compared to the suitability for fenestration. In other words, I believe the impression has been left that those who are ideally suitable for fenestration are also ideally suitable for stapes mobilization. That has not been my experience; that is, in the group in which the stapes is mobilized with the greatest of difficulty, if mobilized at all, the percentage of the results which are successful has been the lowest. The results have been best in those of the early cases, clinical otosclerosis which are not yet suitable for fenestration surgery, and among those there is the highest incidence of regression, again presumably because the otosclerotic process may be still in its spongy or vascular stage. The higher incidence of successes has been in those which have been classified as unsuitable for fenestration surgery because of superimposed inner ear involvement, in which presumably the otosclerotic process has become matured and ischemic or sclerotic.

This slide deals first with the incisions. I do not think that it is necessary to make the complete tympanosympathectomy incision as originally described by Dr. Lempert. Adequate exposure is obtained by making an incision as shown here on the diagram, and this is not an armchair conception. I have movies taken with the Holinger camera to show exactly this same feature.

This slide is the exposure that can be obtained. There are some errors, of course, in the relationships here, but again this kind of exposure can be obtained with much less trauma and with much less postoperative inflammatory reaction. I do think that the stapes mobilization technique is one which eventually will take a place in our treatment of deafness. How much of a place it will take remains to be seen.

HOWARD P. HOUSE, M.D. (Los Angeles, Calif.): This has indeed been a very illuminating discussion, and I think the Council of this Society is to be complimented on presenting this subject here. I had the pleasure of visiting Dr. Rosen last September and observing his work. I certainly compliment him on his technique. It amazed me the small amount of discomfort these patients show. They go through the procedure with practically no discomfort whatsoever; in spite of a gram and one-half of secenal the spectacular improvement began at the time of surgery and the cases that I was able to see post-operatively were indeed most illuminating.

I have confined all of my cases to date to the opposite ear in previously fenestrated cases which have been successfully fenestrated on the one side. I have done so because of the psychological problem which I was going to mention, but which has already been amply covered. It has been my experience that once you have fenestrated successfully on one side, patients are very happy, even though you may get a failure with mobilization on the opposite side. It also offers a wonderful comparison between the two sides in a single individual. As far as my results are concerned, we have had but 22 cases to date. I might say that five of those 22 did obtain adequate hearing equivalent to that obtained on the opposite side, that three additional cases gained improvement but not to the serviceable level. The remainder were plus or minus five db essentially the same, except for one in which there was a 10 db drop by air conduction. This obviously is far too early to discuss or analyze such a small series.

In one case I fenestrated the patient, whom I unsuccessfully attempted to mobilize. The only interesting factor is that the flap was exceedingly thick. It was my pleasure to have Dr. Day with me on that occasion, the thickness of the flap was troublesome at the time and I was concerned as to what might happen subsequently. I was delighted that after six weeks the patient's audiogram showed improved hearing equivalent to the opposite ear. At the present time the flap, although still thick apparently because of scar tissue, is certainly functioning very adequately.

I certainly agree that mobilization is a difficult procedure. I should not like the idea that it is a simple procedure to get around the countryside, and I agree that it should not be done by anyone who is not equipped to carry right on through with the fenestration if the occasion subsequently becomes necessary. I think that further improvements in the technique and the passage of time will provide the answer to the final role of mobilization in otologic surgery.

I compliment Dr. Rosen, not only for his excellent presentation today, but also for focusing our thoughts toward mobilization at this time.

THEODORE E. WALSH, M.D. (St. Louis, Mo.): I do not want to say anything against the concept of reactivating mobilization. It proved

useless in the past; maybe there is a change in technique. I do disagree, however, with Dr. Rosen in his presentation of this condition in his attempt to give us results. I must admit that I was completely misled by the percentages. I am not clear yet as to what his results are in the 200 and more cases he has done. I know he has a few cases who have been done for two or three years with good results, but how many have failed? I still do not know. We have done 16 cases, and we find that out of the 16, a total of six which have been rehabilitated. I mean by that who have had good results for both pure tone audiograms and the speech tests. We have had two that have had a slight improvement but not worth while, and seven that have definitely failed. There is one case that has lost 20 db for speech, and two others that have gone down between 5 and 10 db, so it is not without some danger, I believe. Regarding the question of which cases are suitable, I do not agree with Dr. Rosen that anybody who is suitable for fenestration is suitable for mobilization. Those cases in which the mobilization will fail because of cracking of the crura can be fenestrated very successfully, and they have been done. I have one in this series. I cracked his crura in my attempt at mobilization. I then did a fenestration on his other ear, and he had an excellent result.

KENNETH M. DAY, M.D. (Pittsburgh, Pa.): It has been said that there is nothing new under the sun. Remember that similar procedures were discarded at the turn of the century.

I am going to make a few quotes from Dr. Jack, in 1893: "I do not think that the results of operation in sclerosis are at all encouraging. Mobilization of the stapes gives results for a few weeks and then adhesions reform and the trouble returns."

Dr. Gleason in 1898, A. M. A.: "12 cases, 5 a noticeable and practical improvement of hearing. In one of which improvement lasted for 3 years; then lost. Most showed improvement for a few weeks." Then a comment, "Hearing might have been again improved by remobilization."

Dr. Miot reported 74 good results of 126 cases.

Dr. Sieberman, in 1900, at the American Otological Society: "All attempts at mobilization of the stapes are not only useless, but often harmful."

In 1903, Dr. Jack presented a case of good hearing in both ears ten years following stapedectomy. There was a question from the floor: "How many operations in past year." Answer "none," by Dr. Jack.

Dr. Politzer, 1894, referring to Miot, reported that Miot had 20 good results in 54 operations for otosclerosis. He said "One may conclude that a permanent result is possible only in cases in which adhesions are torn by the manipulation."

Remember that this must be considered as still an experimental procedure. Long term results are not important. There were two main questions; will the improved hearing be maintained? Will the hearing be made worse?

I shall close with a quotation from Virgil: "timeo Danaos et dona ferentes." If you do not know the translation, look it up.

SAMUEL ROSEN, M.D. (New York, N. Y.): Well, first of all I thank Dr. Joseph Goldman for his remarks. He has been very helpful to me, and I have cooperated with him in the study that we are making on the cases that I am doing independently at Mount Sinai Hospital.

Unfortunately, I did not quite understand all of what Dr. Lempert said, so I am not sure that I can answer some of his questions, but I will make an effort to do so. In the first place, I do not want to give the impression, because I do not have this feeling at all nor have I ever had it, that mobilization is going to replace, or is to replace, or is a substitute for fenestration. The two procedures at the present time cannot be compared.

Fenestration started in 1938, and it has taken a long time for fenestration to reach the excellence in technique and understanding that we now have. I do not know why everybody expects that this technique, in a year and one-half or two years of concentrated experience, is going to measure up to fenestration. This is a simple procedure; it is not an easy one, but once you learn, it is very easy to do, and I say that if any patient has a chance of having his hearing restored by this simple procedure; having it done this afternoon, going home tomorrow morning without any post-operative treatment; without having to go back to the doctor often for any reason at all, and can go back to work in a few days; and if it is done by a skillful surgeon, the patient has nothing to lose. I do not understand why the stapedia footplate does not reankylose. This has bothered me since the first time that I mobilized a stapes, and I did not do the second one for a while because I was waiting for the first one to become ankylosed again. I do not understand it. During the operation, for the most part we do not see the footplate of the stapes. We move the neck, and the patient hears, and we do not know what goes on down below, and until we do know, if I said anything, I would not know actually what I was talking about.

If I understand correctly, Dr. Lempert said that this two-featured technique which he is trying now employs the mobilization first, and in the event it does not work he goes right on with the fenestration.

DR. LEMPERT: That is not correct.

DR. ROSEN: Would you mind setting me correct?

DR. LEMPERT: I devised this technique to try to find out how often I can mobilize the stapes, and if I can not I can continue immediately on the table to do my fenestration on the same ear, not on the other ear.

DR. ROSEN: The same ear?

DR. LEMPERT: On the same ear.

DR. ROSEN: You try to mobilize that stapes?

DR. LEMPERT: Yes.

DR. ROSEN: What do you do if you succeed?

DR. LEMPERT: I succeeded in seven out of fifty.

DR. ROSEN: What did you do in the seven?

DR. LEMPERT: I was only investigating this problem. I am interested in studying this problem.

DR. ROSEN: Was it necessary in the successfully mobilized seven cases to fenestrate them?

DR. LEMPERT: Absolutely!

DR. ROSEN: Fenestrated after mobilization?

DR. LEMPERT: Fenestrated, very much necessary, because of the fact that I know what I can get with fenestration, and I do not have to operate

one out of four or one out of five; collecting from five patients in order to give one the chance to hear.

DR. ROSEN: Those are not the figures, Dr. Lempert.

DR. LEMPERT: Those are the figures that I got from the Manhattan Eye and Ear, one in four. That was told to the patients.

DR. ROSEN: 29 per cent in the second place. I will now read you the percentage of the cases that I showed on the screen in A-cases, the number of patients who reached a 30 db level was 48 per cent, in the B-cases 32 per cent, in the C-cases 16 per cent.

Now for the rest, I think that Dr. Lempert will surely come up with something very good soon, because I know this has gotten under his skin a bit, and I am sure he will come up with something a lot better.

DR. LEMPERT: If I had the time I would have shown slides.

DR. ROSEN: Again

DR. LEMPERT: May I ask you a question, not a personal talk between us?

DR. ROSEN: I want to answer the rest of the questions. Again I reiterate that the mobilization is no substitute for fenestration, and it is not intended to be.

I agree with Dr. Kos that time will tell. We have to wait with this thing. Nobody really knows the result. The results that I have I find encouraging, and regardless of what anybody thinks I am going to go ahead and mobilize until the cows come home; I am going to do my best to get better results, improve my technique just as the evolution of fenestration has gone ahead, and so I hope and expect that this will happen also in the mobilization.

As for the past, it is true that Miot and Bucheron and Sieberman and all the rest of the men who did this operation before stopped doing it. Why did they stop doing it? I cannot find a reference anywhere in the literature as to the reason for which they stopped, and so I have to wonder why would I stop if I were doing what they did, and the most logical answer, as far as I am concerned, is that they did not have an adequate view through a myringotomy. I do not believe that this procedure can be done adequately in most cases through a myringotomy. I think it is dangerous to do it that way. That may be the reason why Sieberman said that it not only was useless but harmful, among other things.

Dr. Shambaugh's remarks were very interesting. Most of these remarks were made in the dark, as far as I was concerned, and I cannot read my writing. The slides were being shown, and I was trying to make notes as to what everybody said and I cannot read part of it. At any rate there is a similarity between fenestration and mobilization in that the hearing always goes down after mobilization as it does after fenestration, but the reason for it is altogether different. The Rinne remains negative all throughout post-mobilization period until, if that stapes was mobilized, the hearing comes up and then it becomes positive. I do not believe what happens in two weeks has anything to do with labyrinthine irritation. I think it would be a mistake to get the idea that any labyrinthine irritation occurs after mobilization. I have not seen one case of vertigo after mobilization. In the reports of others who tried mobilization they do not speak of labyrinthitis. I do not believe it is. There surely is no proof of it.

Now Dr. Goodhill's remarks are very interesting. He is very ingenious. He is already doing things that I thought I should be doing, and I hope he keeps on doing them and gets some information for everybody.

Audiometry in the operating room, we have tried; our setup isn't too good as yet, but I think that we will try to better it.

What encourages me is not why it was abandoned, but when men like House, Kos, Shambaugh, Goldman, Walsh and Bellucci say: "Now I have tried this operation. I do not know what its future is going to be, and I am not sure what happens; but I have tried it, and some of these patients are hearing very well," I think that is enough for all of us to try a simple innocuous procedure.

I thank Dr. Day, Dr. Nash and the Society for giving me this opportunity to present this work. This really is a happy day for me, and I thank you very much.

SOUTH CAROLINA SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY.

Plans have been completed for a joint meeting of the North Carolina Eye, Ear, Nose and Throat Society and the South Carolina Society of Ophthalmology and Otolaryngology at Columbia, S. C., on September 12, 13, and 14, 1955. Headquarters will be the Columbia Hotel.

The following ophthalmologists will be on the program: Dr. E. W. D. Norton of New York, Dr. Frank Carroll of New York, and Dr. William B. Clark of New Orleans.

An announcement of three guest otolaryngologists will be made later.

A most attractive program has been arranged. For further information address Roderick Macdonald, M.D., Secretary and Treasurer, 330 East Main Street, Rock Hill, S. C.

COURSE IN RHINOPLASTY, RECONSTRUCTIVE SURGERY OF NASAL SEPTUM AND OTOPLASTY.

An intensive postgraduate course in Rhinoplasty, Reconstructive Surgery of the Nasal Septum and Otoplasty will be given July 16, 1955, to July 30, 1955, by Dr. Irving B. Goldman and staff at The Mount Sinai Hospital, New York City, in affiliation with Columbia University.

Candidates should apply to Registrar for Postgraduate Medical Instruction, The Mount Sinai Hospital, 5th Avenue and 100th Street, New York 29, New York.

WOODEN FOREIGN BODIES IN THE PARANASAL SINUSES.

MERRILL LINEBACK, M.D.,
Atlanta, Ga.

The unusual circumstances in the acquiring of vegetable foreign bodies in the antra are deemed of sufficient interest to warrant reporting the two following cases. The importance of anaerobic cultures and sensitivity testing in the bacteriological handling of infection is emphasized. The possibility of tumor, either benign or malignant, is suggested when only one sinus is involved. To the differential diagnosis of single sinus affection must now be added the possibility of presence of a foreign body of the non-opaque variety, especially if nothing suggests it in the X-ray.

CASE REPORTS.

Case 1: Mr. T. S. S., while serving as a revenue agent for the government was assigned the case of a North Georgia moonshiner in September of 1935. During the course of a chase in attempting to bring the culprit

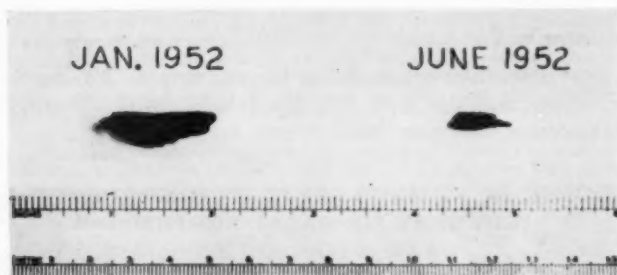


Fig. 1. The two pieces of wood blown from the nose of Case 1.

to justice the latter took off through a hardwood "thicket" common in the Georgia foothills, and the agent had to bend forward almost double in order to negotiate the low lying branches. He did not get very far,

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for the next thing he remembered was waking up in a small town practitioner's office with a twig sticking out of his left eye. He stated that this was pulled out and the cut eyelids sutured. No damage ensued to the eye itself.



Fig. 2. Pre-operative X-ray of Case 2. Showing only the left antrum diffusely cloudy. No foreign body can be detected.

Until 1943 he remained symptom free, and in the Fall of that year began to have headaches for which he was checked by his dentist, who found the teeth in good shape.

He consulted his physician in Alabama, in 1945 who, after X-rays revealed pus in the left antrum, suggested that he undergo an operation,



Fig. 3. Post-lipiodol injection into the left antrum of Case 2. This shows merely thickened lining membrane and still nothing that can be identified as a foreign body.

but the agent declined. In January, and again in June, of 1952 he blew some pieces of wood out of the left side of his nose (see Fig. 1). He was X-rayed and again advised to undergo left Caldwell-Luc for removal of a large foreign body that apparently had been in the left antrum for 17 years. He again declined.

Case 2: Mr. H. R. P., a 33-year-old refrigeration expert, had spent what he termed "two fortunes" for penicillin "shots" in a vain attempt to clear up his left maxillary sinusitis. He related how he'd seen practically every physician east of the Mississippi River and still had his infection. It was suggested that the only remaining avenue to investigate was a direct view of the left antrum at operation. X-rays (see Fig. 2) revealed that the left maxillary antrum only was involved in suppuration, and in this respect a primary tumor, either benign or possibly malignant, was conjectured. He was admitted to the hospital, where a left antrum

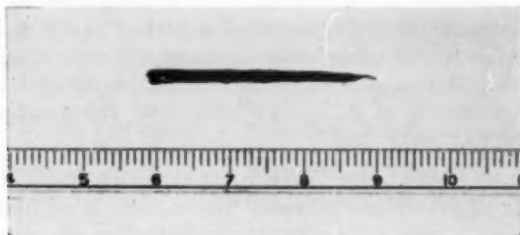


Fig. 4. Foreign body of Case 2.

aspiration revealed pus which on culture proved to be a pneumococcus that was resistant to penicillin, but was sensitive to tetracycline. A week of this drug and redrainage of the left antrum still showed pus, indicating that the lining membrane was non-functioning, and that a Caldwell-Luc was next to be done. Lipiodol injected into the left antrum revealed thickened membrane (see Fig. 3).

At operation on March 31, 1954, halfway through the procedure, the Green's forceps pulled out what was at first thought to be a toothpick (see Fig. 4). While the operation was completed, curiosity and conjecture ran high as to how such a foreign body could get inside the antrum.

When the patient was sufficiently awake he recalled that at the age of five years, 28 years previously, he was "poaching" some succulent but forbidden pears in his grandfather's orchard in Worcester, Mass. He was using a broken broom handle and throwing it up to knock down the fruit. He remembered that one time it hit his face end-on and "hurt quite a bit," but he never mentioned the incident for fear of punishment. Close inspection of the left cheek revealed a small dimple in the left naso-labial fold at about the level of the intra-antral position of the foreign body.

Post-operatively he was back at work within a month. To date, March, 1955, he has had no more complaints referable to his sinuses.

DISCUSSION.

Metallic substances and glass particles are the usual, if rare

bodies, that lodge in the sinuses. They are propelled more often into the maxillary sinuses by explosives or during the course of automobile accidents and the like. The recent World Wars have given numerous instances of rifle, pistol or shrapnel missiles that usually completely penetrate the involved sinus. Rarely do these objects remain in the cavity, being spent if such is the case.

Even more unusual is the presence of non-radio-opaque vegetable foreign matter in the sinuses; and in Case 2, the relatively long period of time (28 years) the piece of wood had remained within the sinus itself without causing symptoms. Kelemen¹ in 1945 presented a case of spontaneous expulsion of a wooden foreign body from the nose after being present for 28 years. What is so remarkable about Case 2 is that the presence of a foreign body was unsuspected until operation was performed.

Emphasis needs to be placed upon thorough history taking and study of the individual case. The patient in all likelihood, as in Case 2, may have completely forgotten the particular incident involving a foreign body, and much valuable time can be wasted in treating a sinus thought to be merely chronically infected, when in reality, foreign matter is at the root of the condition.

A further differential point is to be considered when only one sinus apparently is involved: a primary tumor, either malignant or benign, is a strong probability in the absence of other sinus involvement. This can be ruled out easily with biopsy, and in view of Case 2, a foreign body of vegetable nature should be carefully searched for at the same time.

SUMMARY.

1. Two unusual foreign bodies involving the left maxillary antrum are presented, one having been present for 17 years, the other for 28 years.

2. Being vegetable matter they did not show up on X-ray examination.

3. Each patient was symptom-free until his case presented as a "sinusitis" and the usual antibiotic of the time (penicillin) proved to be of no avail.

4. Bacteriological examination of one case proved that the causative organism was resistant to penicillin, but on sensitivity testing was amenable to Achromycin-Tetracycline. It cannot be too strongly urged that sterile technique and culturing with anerobic procedure be routine when one is dealing with a micro-aerophilic space, such as an infected antrum.

5. A single involved sinus should make one suspect something out of the ordinary; such as either a tumor, or in view of these two cases, the presence of a foreign body, especially if the X-ray examination is negative for an opaque substance.

6. The foreign body in Case 2 gave no evidence of spontaneous expulsion. The patient conceivably would never have known of the object had he not been subjected to Caldwell-Luc.

7. Adequate anamnesis is absolutely essential.

I express my thanks to Dr. Scott L. Tarplee of Atlanta, Ga., for his referral of Case 1 to me, and to Mr. John S. Goings, of Decatur, Ga., for making the photographs.

REFERENCE.

1. KELEMEN, GEORGE: Spontaneous Expulsion of a Foreign Body by Transmigration Through the Nasal Wall after Twenty-eight Years. *THE LARYNGOSCOPE*, 55:3-7, July, 1945.

28 Eighth Street, N.E.

TRACHEOSTOMY SCAR REVISION.

H. CLINTON DAVIS, M.D.,

BENJAMIN MUSSER, M.D.,*

and

L. G. GLASSON, M.D.,

Miami, Fla.

The ever-increasing use of tracheostomy as an adjunct in medicine and surgery, and the resulting lives saved, has made the physician more aware of the typical secondary intention scar deformities (see Figs. 1, 2, 3, 4). Often the operation is performed hastily for life-saving reasons without thought of cosmetic planning. When tracheostomy is used in conjunction with other surgery, its role becomes secondary, and little attention is directed toward the esthetic outcome. Even after the most careful execution of the operation the result is frequently spoiled by keloid formation (see Fig. 1), widening of the scar centrally (see Fig. 2), and by adherence of the skin and platysma to the deep fascia and trachea. The latter problem causes an upward angulation of the wound on deglutition (see Fig. 3), while the former exhibits constant deformity. Surgical considerations with regard to the revision of these cicatricial lesions will serve as the basis of this discussion.

The patient will generally seek the physician's help because of the unsightly scar, or because of a sense of tugging with each swallow. Occasionally he may volunteer that the contour of an elevated keloid scar interferes with shaving.

Surgical correction is directed toward complete excision of the scar with reapproximation of the skin margins in the transverse manner whenever possible. When the vertical component of the scar is too great, a modified T-type repair will

* Dr. Musser is now located at Hahnemann Hospital, Philadelphia.

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generally bring the deformity below the collar level (see Fig 4). Tension on the skin flaps should be minimal. Frequently wide undermining of the cutaneo-platysmal layer is necessary to mobilize sufficient skin for a satisfactory closure. Delicate handling of tissue and plastic technique are essential for optimal results.



Fig. 1. Vertical scar with keloid change.

Tracheostomy scar revision is a hospital procedure. The operation is always an elective one and should be performed in the good risk patient only. Endotracheal general anesthesia is strongly advised. The patient is positioned on the operating table in the supine position with 2 small pillows beneath the shoulders, as in the method for thyroid surgery. Skin preparation and draping are carried out in the routine manner. Protective wound towels on the incisional margins are avoided.

In planning the scar revision the cutaneous margins should be fashioned in such a way that the wound will have a gentle, upward, lateral curve. This will pose no problem if the original incision is of the transverse variety; however, if it is of the vertical type, the ellipse of skin to be excised must have more curve on its inferior margin in the conversion to a transverse scar.



Fig. 2. Horizontal scar with keloid change.

The incision is made through the skin, subcutaneous fat and platysma muscle to the underlying fascial layer. Here the dissection can be extended in all directions in a near bloodless plane. Special care is necessary to locate and avoid injury to the anterior jugular veins because of possible air embolism. The external jugular veins are usually too lateral to be traumatized. In some instances it may be imperative to mobilize the superior skin flap to the hyoid bone; the inferior wound margin can be freed for a considerable distance over the anterior thorax.

Diastasis of the ribbon muscles at the site of the tracheostomy frequently results in adherence between the platysma muscle and the trachea. This problem is corrected by mobili-

zation and reapproximation of the sternohyoid muscle at the site of separation.

After the anesthetist removes the shoulder pillow the platysma muscle is closed as a separate layer with interrupted sutures of fine cotton or silk. The skin is then sutured with 4-0 or 5-0 silk, or fine stainless steel wire. No drains are used. Hemostasis should be absolute before closing the wound.

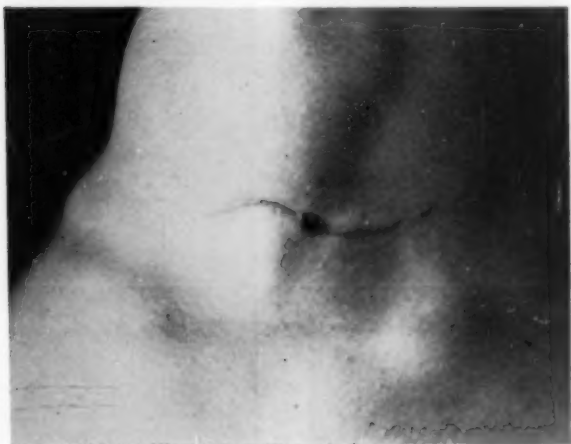


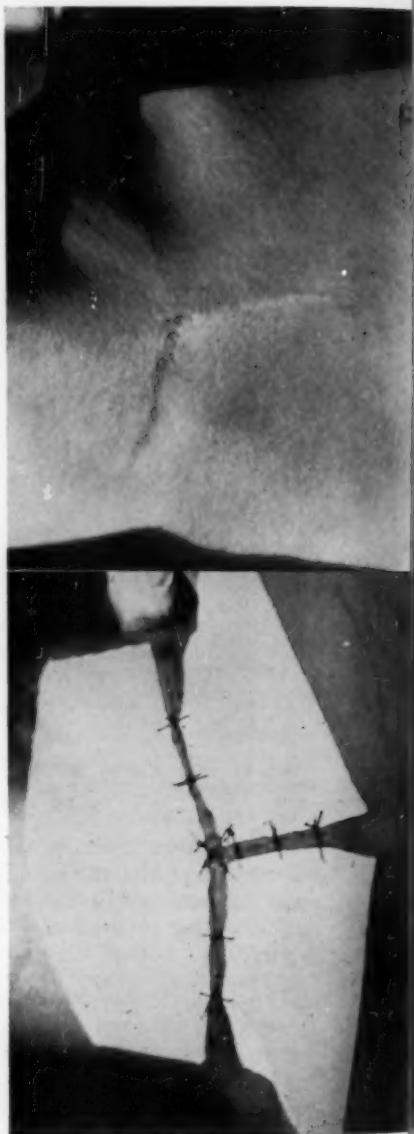
Fig. 3. Adherence of platysma muscle to trachea with deformity of deglutition in the central portion of the wound.

Gentle even pressure is applied to the external dressing by the use of sterile mechanic's waste. Cutaneous sutures are removed within four to five days. Wound margins are then supported by external tape splints for an additional eight to ten days.

The results of tracheostomy scar revision are usually gratifying to both the patient and the surgeon. Occasionally during the follow-up period one may observe stretching of the scar in its midportion (the point of greatest tension). A secondary revision may be required. Individuals with a tendency to keloid formation should receive a course of X-ray therapy in



Fig. 4. T-type repair of concave deformity following emergency tracheostomy many years before.



the immediate postrevision period. Time will frequently improve the adherent type of deformity, so revision should be delayed to give nature a chance.

SUMMARY.

The several varieties of common tracheostomy scar deformities are presented. Their surgical correction is discussed.
939 duPont Building.

UNIVERSITY OF ILLINOIS ANNUAL ASSEMBLY IN OTOLARYNGOLOGY.

The Department of Otolaryngology, University of Illinois College of Medicine, announces its Annual Assembly of Otolaryngology from September 19 through October 1, 1955. This Assembly will consist of two parts:

Part I — September 19 through September 24, 1955, will be devoted to surgical anatomy of the head and neck, fundamental principles of neck surgery and histopathology of the ear, nose and throat. This week will be under the personal direction of Maurice F. Snitman, M.D.

Part II — September 26 through October 1, 1955, will be devoted entirely to lectures and panel discussion of advancements in otolaryngology. The chairman of this section will be Emanuele M. Skolnik, M.D.

Registration is optional for one or both weeks. For further information, address Dr. Francis L. Lederer, 1853 West Polk St., Chicago 13, Ill.

POST-GRADUATE COURSES AT TEMPLE UNIVERSITY.

The following Post-Graduate Courses to be given in this Department during the current year:

Post-Graduate Course in Broncho-Esophagology, June 13-24, 1955; October 17-28, 1955.

Post-Graduate Course in Laryngology and Laryngeal Surgery, September 19-30, 1955.

These courses are all to be given in the Department of Laryngology and Broncho-esophagology, Temple University Hospital and School of Medicine, under the direction of Dr. Chevalier L. Jackson and Dr. Charles M. Norris. The tuition fee for each course is \$250.00. Further information and application blanks can be obtained from Dr. Chevalier L. Jackson, 3401 N. Broad Street, Philadelphia 40, Pennsylvania.

BRONCHESOPHAGOLGY COURSE

The next Bronchoesophagology Course to be given by the University of Illinois College of Medicine is scheduled for the period October 24 to November 5, 1955, under the direction of Dr. Paul H. Holinger.

Interested registrants will please write directly to the Department of Otolaryngology, University of Illinois College of Medicine, 1853 West Polk Street, Chicago 12, Illinois.

NEW YORK EYE AND EAR INFIRMARY. ALUMNI ASSOCIATION DINNER.

A subscription dinner honoring Edgar B. Burchell, D.Sc. on the completion of 60 years of distinguished service at the New York Eye and Ear Infirmary, will be given on June 10, 1955, at the 7th Regiment Mess, 643 Park Avenue, at 67th Street, New York City. Cocktails and reception at 6:30, dinner at 7:30 P.M. For further information write to Dr. Joseph H. Krug, Secretary-Treasurer, Alumni Association, New York Eye and Ear Infirmary, 218 Second Avenue, New York City.

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